

5 This application claims the benefit of the filing date of United States Patent Application Serial No. 16/132,090, filed September 14, 2018, for “Card-Handling Devices and Related Methods, Assemblies, and Components,” the disclosure of which is incorporated herein by reference.

The disclosure relates to card-handling devices and related assemblies, components, and methods. In particular, embodiments of the disclosure relate to card-handling devices, card input portions of card-handling devices, card output portions of card-handling devices, card-shuffling carousels of card-handling devices, and methods of shuffling cards.

Wagering games are often based on the outcome of randomly generated arrangements of cards. Such games are widely played in gaming establishments and, often, a single deck or multiple decks of fifty-two (52) playing cards may be used to play the game. Gaming using multiple decks of playing cards may include, for example, six to ten decks used in games such as blackjack and baccarat and two decks of playing cards used in games such as double deck blackjack. Many other specialty games may use single or multiple decks of cards, with or without jokers and with or without selected cards removed.

The desire to decrease shuffling time has led to the development of mechanical and electromechanical card-shuffling devices. Such devices increase the speed of shuffling and

- 2 -

dealing, thereby increasing actual playing time. Such devices also add to the excitement of a game by reducing the amount of time the dealer or house has to spend in preparing to play the game.

However, the card output area or shoe used in conjunction with shufflers often places strain on dealers' hands and wrists by using card distribution interfaces to output cards that are oriented at a substantial acute angle relative to the table surface. To draw cards from these shoes, dealers often have to twist their wrists repeatedly at awkward and uncomfortable angles. Moreover, shoes often are not easily adjustable to meet a dealer's card drawing preference (*e.g.*, direction in which dealers prefer to draw a card relative to the table).

Card counting is also a significant problem, for example, when using automatic card shufflers or hand shuffling. Casinos often lose a house advantage when players are able to predict what cards remain to be dealt and the proximity of those cards to being dealt. It is desirable for casinos to reduce or eliminate the ability for players to count cards. Continuous shuffling machines assist in reducing the ability to count cards, but additional ways to eliminate card counting and improve ergonomics of card delivery may be desirable.

DISCLOSURE

Some embodiments of the present disclosure may include a card-handling device including a playing card-shuffling apparatus and a card rotation device. The card rotation device may be configured to rotate one or more playing cards about a minor axis of the one or more playing cards to alter an orientation of lateral edges of the one or more playing cards. The minor axis of the one or more playing cards extends 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. The card rotation device may be configured to rotate the one or more playing cards as at least one of the one or more playing cards enters the shuffling apparatus.

Some embodiments of the present disclosure may include a card-handling device including a card input configured to rotate at least one playing card from a group of playing cards about a minor axis of the at least one playing card to alter an orientation of lateral edges of the at least one playing card. The minor axis of the at least one playing card extends through the thickness of the at least one playing card in a direction transverse to a longitudinal axis and lateral axis of the at least one playing card. The card input may be

- 3 -

configured to enable the at least one playing card to be provided to a card-shuffling apparatus for shuffling playing cards after the orientation of the at least one playing card has been altered.

Some embodiments of the present disclosure may include a card-handling device
5 configured to be mounted at or proximate a gaming surface. The card-handling device may include a card-shuffling apparatus and a card rotation device. The card rotation device may be configured to receive playing cards in a substantially flat orientation and alter an orientation of a leading edge of at least some of the playing cards while maintaining at least some of the playing cards in the substantially flat orientation.

10 Some embodiments of the present disclosure may include a card-handling device configured to be positioned at a gaming structure having a playing surface. The card-handling device may include a card-shuffling apparatus and a card output portion. The card output portion may be configured to receive playing cards from the card-shuffling apparatus when the card output portion is in a first position. The playing cards may be
15 positioned by the card-shuffling apparatus to be received into the card output portion with major faces of the playing cards oriented in a plane substantially transverse to the playing surface. The card output portion may be further configured to transport the playing cards to a second position where at least a portion of the card output portion is accessible from the playing surface.

20 Some embodiments of the present disclosure may include a method of shuffling cards. The method may include inputting cards into a card rotation device. The method may include rotating the card rotation device about a minor axis of the cards to alter an orientation of lateral edges of the cards to randomize an orientation of the lateral edges of the cards. The minor axis of the cards extends through a thickness of the cards in a
25 direction transverse to a longitudinal axis and a lateral axis of the cards. The method may further include transporting the cards from the card rotation device into a card-shuffling apparatus. The method may include outputting at least one card from the card-shuffling apparatus into a card output area.

Some embodiments of the present disclosure may include a method of shuffling
30 cards. The method may include inputting cards into a card-handling device in an orientation substantially parallel to a horizontal plane. The method may include transporting the cards to a card-shuffling apparatus. The method may further include

- 4 -

outputting the cards into a card output area in an orientation substantially perpendicular to the horizontal plane.

Some embodiments of the present disclosure may include a card-handling device including a card-shuffling apparatus. The card-shuffling apparatus may include a carousel
5 having a number of compartments, for example, at least one-hundred compartments. The compartments may be arranged radially about the carousel and configured to hold between one and ten cards in each compartment.

Some embodiments of the present disclosure may include a card-shuffling carousel including compartments arranged radially about the carousel. The compartments may be
10 configured to hold at least one card. The compartments may include an aperture defined by at least two arms and a resilient material. The resilient material may extend between a bottom retention and a top retention in at least one of the at least two arms. The resilient material may have a length greater than a distance between the bottom retention and the top retention. At least one of the bottom retention and the top retention may be a movable
15 connection.

Some embodiments of the present disclosure include a card-handling device for use with a gaming surface. The card-handling device may include a retractable card input portion, a transportation device, a card-shuffling apparatus, and a card outlet. The retractable card input portion may be configured to receive playing cards in an orientation
20 substantially parallel to the gaming surface. The transportation device may be configured to transfer the playing cards from the retractable card input portion to the card-shuffling apparatus within the card-handling device. The card outlet may be configured to receive the playing cards from the card-shuffling apparatus and deliver the playing cards to a location proximate the gaming surface in an orientation substantially transverse to the
25 gaming surface.

Some embodiments of the present disclosure may include a card-handling device configured to be positioned at least partially below a gaming table upper surface. The card-handling device may include a card intake area, a card-shuffling apparatus, and an output area. The card intake area may be configured to feed cards into the card-shuffling
30 apparatus in an orientation substantially parallel to a surface of the gaming table. The output area may be configured to receive the cards from the card-shuffling apparatus in an orientation substantially transverse to the surface of the gaming table in an area beneath the

- 5 -

surface of the gaming table and transport the cards to an area at least partially above the surface of the gaming table.

BRIEF DESCRIPTION OF THE DRAWINGS

5 While the specification concludes with claims particularly pointing out and distinctly claiming embodiments of the present disclosure, the advantages of embodiments of the disclosure may be more readily ascertained from the following description of embodiments of the disclosure when read in conjunction with the accompanying drawings in which:

10 FIG. 1 shows an isometric view of an embodiment of the present disclosure with covers removed to show the internal mechanism;

 FIG. 2 shows an isometric view of an embodiment of the present disclosure with covers removed to show the internal mechanism;

15 FIG. 3 shows an isometric view of a card intake area according to an embodiment of the present disclosure;

 FIG. 4 shows an elevational side view of an embodiment of the present disclosure with covers removed to show the internal mechanism;

 FIG. 5 show a section view of an elevational side view of an embodiment of the present disclosure;

20 FIG. 6 shows an enlarged view of a section view of a card input portion according to an embodiment of the present disclosure;

 FIG. 7 shows an enlarged view of a section view of a card-shuffling apparatus according to an embodiment of the present disclosure;

25 FIG. 8 shows an enlarged view of a compartment module according to an embodiment of the present disclosure;

 FIG. 9 shows an enlarged view of a card output portion according to an embodiment of the present disclosure with additional covers removed to show the internal mechanism;

30 FIG. 10 shows an enlarged view of a section view of a card outlet storage container according to an embodiment of the present disclosure;

 FIG. 11 is a process diagram for the shuffling of playing cards according to an embodiment of the present disclosure; and

- 6 -

FIG. 12 is a process diagram for the shuffling of playing cards according to an embodiment of the present disclosure.

MODE(S) FOR CARRYING OUT THE INVENTION

5 The illustrations presented herein are not meant to be actual views of any particular card-handling device or component thereof, but are merely idealized representations employed to describe illustrative embodiments. The drawings are not necessarily to scale. Elements common between figures may retain the same numerical designation.

 As used herein, any relational term, such as “first,” “second,” “over,” “beneath,”
10 “top,” “bottom,” “underlying,” “up,” “down,” *etc.*, is used for clarity and convenience in understanding the disclosure and accompanying drawings, and does not connote or depend on any specific preference, orientation, or order, except where the context clearly indicates otherwise. For example, these terms may refer to an orientation of elements of the card-handling device relative to a surface of a table on which the card-handling device may be
15 positioned, mounted, and/or operated (*e.g.*, as illustrated in the figures).

 As used herein, the terms “vertical” and “horizontal” may refer to a drawing figure as oriented on the drawing sheet, and are in no way limiting of orientation of an apparatus, or any portion thereof, unless it is apparent that a particular orientation of the apparatus is necessary or desirable for operation in view of gravitational forces. For example, when
20 referring to elements illustrated in the figures, the terms “vertical” or “horizontal” may refer to an orientation of elements of the card-handling device relative to a table surface of a table to which the card-handling device may be mounted and operated.

 As used herein, the term “and/or” means and includes any and all combinations of one or more of the associated listed items.

25 As used herein, the terms “substantially,” “approximately,” or “about” in reference to a given parameter means and includes to a degree that one skilled in the art would understand that the given parameter, property, or condition is met with a degree of variance, such as within acceptable manufacturing tolerances, or wherein the variance is with respect to a general parameter, such as an orientation. For example, a parameter that
30 is substantially met may be at least about 90% met, at least about 95% met, or even at least about 99% met.

 Some embodiments of the present disclosure may include card-handling devices having a card rotation device (*e.g.*, rotatable card input portion, rotatable card intake,

- 7 -

rotating elevator, rotating card input device, *etc.*). The card rotation device may rotate playing cards about a minor axis, normal to a face of the cards, such that an orientation of the lateral edges of the playing cards may be randomized, for example, before entering a shuffling apparatus. Randomizing the orientation of the lateral edges of the playing cards
5 may work to prevent some forms of card manipulation, card recognition, or card counting that are becoming more prevalent in games involving playing cards, for example, by recognizing any visual edge variations (*e.g.*, edge sorting), differences, and/or anomalies, from manufacture, handling or intentional marking.

Some embodiments of the present disclosure may include a card output storage area
10 (*e.g.*, area where the playing cards are stored after exiting the shuffling apparatus and before entering the gaming area) that stores the playing cards in a substantially horizontal stack. The cards may exit the shuffling apparatus in a substantially vertical orientation (*e.g.*, where a major face of the cards lies in a plane normal to the gaming area). The card output storage area may receive the cards in substantially the same orientation as the cards
15 exiting the shuffling apparatus. A horizontal card output storage area may provide for additional storage space allowing the use of greater numbers of decks over existing designs and may allow for more compact designs providing more efficient use of space.

Some embodiments may include a shuffling apparatus capable of handling greater numbers of cards than conventional designs. The shuffling apparatus may include multiple
20 compartments for holding cards. In some embodiments, the compartments may include a securing element and a card-handling aperture to make more efficient use of space allowing for a more compact arrangement of the compartments and provide an increased capacity for the shuffling apparatus. In some embodiments, the compartments may be modular, which may result in efficiency improvements especially for repair and
25 replacement of compartments.

FIG. 1 shows a perspective view of a card-handling device 100, according to an embodiment of the present disclosure, having portions of one or more housings (*e.g.*, covers) of the card-handling device 100 removed to show interior components of the card-handling device 100. The card-handling device 100 may be configured to be mounted with
30 at least a majority of the card-handling device 100 beneath a level of a gaming structure, for example, a table surface (*e.g.*, a gaming table surface) of a table (*e.g.*, a gaming table) and to deliver shuffled playing cards to the table surface and/or receive playing cards to be shuffled from or proximate the table surface. The card-handling device 100 may include a

- 8 -

frame structure 102, a control system 104 in communication with one or more displays 105, 106, and a substantially flat top surface 108 that may be substantially co-planar with the table surface when placed for use with the table. In some embodiments, the control system 104 may include an integrated control panel and/or display 105, which may be
5 utilized by an operator (e.g., a dealer) to operate the card-handling device 100. The integrated control panel and/or display 105 may be positioned to face in a direction toward an expected position of the operator. In some embodiments, the display 106 may be positioned to face in a direction toward an expected position of the players at a gaming surface or table and may be utilized to display game related information (e.g., games odds,
10 game table limits, advertisements, etc.) to the players.

As discussed herein, any disclosure regarding the functioning of the card-handling device 100 and associated components may be performed (e.g., automatically performed without operator intervention) by one or more portions (e.g., local or remote portions) of the card-handling device 100 (e.g., one or more processors of the control system 104,
15 optionally along with associated memory). In other embodiments, the functions may be at least partially performed by (e.g., by inputting one or more commands into the control system 104 or manually), or assisted by, the operator.

FIG. 2 shows a perspective view of the card-handling device 100, according to an embodiment of the present disclosure, having portions of one or more housings (e.g.,
20 covers) of the card-handling device 100 removed to show interior components of the card-handling device 100. The card-handling device 100 may include a card input portion 110 and a card output portion 112. In some embodiments, the card input portion 110 may be configured to move (e.g., elevate) a card intake area 202 toward (e.g., above) the top surface 108 when an operator (e.g., dealer) needs to interact with the card input portion
25 110, such as, for example, to insert playing cards that are ready to be shuffled into the card intake area 202. The card input portion 110 may retract the card intake area 202 below the top surface 108, as shown in FIG. 1, when the operator does not need to interact with the card input portion 110, or when the playing cards collected in the card intake area 202 are to be shuffled. In some embodiments, the card output portion 112 may be configured to
30 elevate an card outlet 204 and hold a group of shuffled cards 205 above the top surface 108 when an operator needs to interact with the card output portion 112, such as, for example, to remove playing cards 205 that have been shuffled from the card outlet 204 or to enter the cards 205 into game play (e.g., dealing or drawing). The card outlet 204 may retract the

- 9 -

card outlet 204 below the top surface 108, as shown in FIG. 1, when the operator does not need to interact with the card outlet 204, or when the playing cards collected in the card-shuffling apparatus 114 have been shuffled and are ready to be inserted into the card outlet 204 for reentry into game play.

- 5 In some embodiments, the card intake area 202 may have a partially enclosed internal volume, for example, defined by at least two walls 206. For example, the card intake area 202 may have a first sidewall 206a and a second sidewall 206b, such that the playing cards can only be placed in the card intake area 202 in one orientation. In some embodiments, the card intake area 202 may include a back wall 206c to regulate the
- 10 uniformity of the stack of playing cards in the intake area 202 by providing a uniform stop when cards are placed in the intake area 202. In some embodiments, the card intake area may include a top wall 206d (*e.g.*, a fixed top wall 206d) and or a bottom wall 206e further defining the intake area. In other embodiments, the top wall 206d may be rotatable to open an upper portion of the card intake area 202 for access from above. In some embodiments,
- 15 the card intake area 202 may include an open face 208 sized and configured to enable cards to be placed within the card intake area 202. In some embodiments, the open face 208 may be a front face of the card intake area 202. In some embodiments, the open face may be a top face. In other embodiments, the open face may be more than one face of the card intake area 202, such as, for example, the front face and a side face, wherein the card intake
- 20 area 202 is defined by a first sidewall 206a and a back wall 206c, a first sidewall 206a, a back wall 206c, and a top wall 206d, or any other combination of walls 206. In some embodiments, the card intake area 202 may be defined by walls 206 on every face. For example, the card intake area may be defined by a first sidewall 206a, a second sidewall 206b, a back wall 206c, a top wall 206d, a bottom wall 206e, and a front wall. In some
- 25 embodiments, at least one of the walls 206 may include an open area (*e.g.*, slot, aperture, hole, cutout, or gap) and/or may be movable to enable the playing cards to be inserted into the card intake area. In some embodiments, the sidewalls 206a, 206b may coincide with a long dimension of the playing cards (*e.g.*, longitudinal axis) and the back wall 206c may coincide with a short dimension of the playing cards (*e.g.*, lateral axis).
- 30 In some embodiments, the card intake area 202 may be configured to hold up to 650 playing cards, such as, between about 50 playing cards and about 650 playing cards, or between about 500 playing cards and about 600 playing cards, or about 520 playing cards

- 10 -

(*e.g.*, about ten decks of cards with or without extra cards, such as wild or other special cards).

In some embodiments, the card intake area 202 and card outlet 204 may be configured to elevate and retract relative to the top surface 108 of the card-handling device 100. The card intake area 202 and card outlet 204 may retract below the gaming surface, such that the card-handling device 100 with the exception of display 106, has a minimal, if any profile above the gaming surface, as shown in FIG. 1 (*e.g.*, may be positioned entirely below the top surface 108). A lid 203 may open and close to enable the card intake area 202 to be elevated over the top surface 108 and to enclose the card intake area 202 in the card-handling device 100 when the card intake area 202 is retracted. In some embodiments, the lid 203 may rotate between open and closed positions (*e.g.*, on a hinge). In other embodiments, the lid 203 may move in a different manner, for example, the lid 203 may be coupled to the card intake area 202 (*e.g.*, at top wall 206d) and may translate above the top surface 108 as the card intake area 202 is elevated. An outlet lid 209 may open and close to enable the card outlet 204 to be elevated over the top surface 108 and to enclose the card output portion 112 in the card-handling device 100 when the card outlet 204 is retracted. In some embodiments, the outlet lid 209 may rotate between open and closed positions. In other embodiments, the outlet lid 209 may move in a different manner, for example, the lid 209 may be coupled to the card outlet 204 and may translate above the top surface 108 as the card outlet 204 is elevated.

Maintaining a low profile while not in use may reduce the area required for the card-handling device in or adjacent to gaming tables, which may reduce the size required for a gaming table to occupy. In some embodiments, the card-handling device 100 may have a profile such that the top surface 108 may be incorporated into the gaming surface with the game being played on at least a portion of the top surface 108 of the card-handling device 100, which may result in the dedicated space for the card-handling device 100 in the surface of the gaming table being reduced and/or eliminated. In other embodiments, the card-handling device may be placed adjacent to a gaming table on the dealer side thereof, and supported by the gaming table via a bracket system or on the casino floor with height-adjustable legs or a pedestal.

FIG. 3 shows an isometric view of the card intake area 202 of the card-handling device 100 in an elevated position. In some embodiments, the card intake area 202 may include at least one sidewall 206a, 206b, a back wall 206c, a top wall 206d, and a bottom

- 11 -

wall 206e. In some embodiments, a gap 302 may be defined between at least one of the sidewalls 206a, 206b and the bottom wall 206e (*e.g.*, both of the sidewalls 206a, 206b). The gap 302 may be large enough that at least one card may pass through the gap 302 in order to be moved further into the card-handling device 100 for a shuffling operation. In
5 some embodiments, the gap 302 may be defined in at least one of a back wall 206c and/or a front wall.

In some embodiments, the bottom wall 206e may include at least one aperture 304 (*e.g.*, void, opening, hole, *etc.*). In some embodiments, the at least one aperture 304 may allow the card input portion 110 (FIG. 2) of the card-handling device 100 (FIG. 2) to
10 interface with unshuffled cards stored within the card intake area 202. For example, idler and/or pick-off rollers 610 (FIG. 6) may protrude through the at least one aperture 304 to interface with at least one card that may be resting on the bottom wall 206e in order to move the at least one card through the gap 302 and out of the card intake area 202.

In some embodiments, the card intake area 202 includes an open face 208 for
15 receiving unshuffled cards. In some embodiments, the open face 208 may include retention brackets 312 configured to secure the cards within the card intake area 202. For example, the retention brackets 312 may be automated such that, when the card intake area 202 arrives in the elevated position, the retention brackets 312 may open providing a substantially enlarged area in the open face 208 for inputting unshuffled cards. Before the
20 card intake area 202 retracts, the retention brackets 312 may close at least partially blocking the open face 208 such that the unshuffled cards when in a horizontal position cannot be inserted or removed through the open face 208. The retention brackets 312 may then secure the unshuffled cards within the card intake area 202 during the elevating and/or retracting motion of the card intake area 202. In some embodiments, the retention
25 brackets 312 may be manually operated by the operator. For example, the operator may input a command into the control system 104 (FIG. 1, which may include an input and a display) to open and/or close the retention brackets 312 or the operator may directly manipulate the retention brackets 312 between open and closed or secured positions.

In some embodiments, the retention brackets 312 may have biasing elements 314
30 (*e.g.*, springs, resilient members, compressible fluid, *etc.*) configured to bias the retention brackets 312 toward a closed position. In some embodiments, the retention brackets 312 may have an angular face 316, such that, when the operator inserts the unshuffled cards between the retention brackets 312 the retention brackets 312 are forced into an open

- 12 -

position by the interface between the unshuffled cards and the angular face 316 of the retention brackets 312. The biasing elements 314 may return the retention brackets 312 to a closed position after the unshuffled cards have passed through the open face 208 between the retention brackets 312.

5 In some embodiments, the card intake area 202 may include a rotational input 308 (*e.g.*, spindle, gear, shaft, differential, motor, gearbox, or cog). The rotational input 308 may be configured to rotate the card intake area 202 about a vertical axis 310 of the card intake area 202. In some embodiments, the vertical axis 310 may coincide with a minor axis of the unshuffled cards retained within the card intake area 202. The minor axis of the
10 unshuffled cards may extend through a thickness of the unshuffled cards in a direction transverse to a longitudinal axis and a lateral axis of the unshuffled cards (*e.g.*, axes extending along the major faces of the cards). For example, the thickness may extend from a front major face of the card to a back major face of the card.

 In some embodiments, the rotational input 308 may be configured to rotate the card
15 intake area 202 when in an elevated position and/or in a retracted position. For example, the rotational input 308 may be configured to rotate the card intake area 202 while transitioning from the elevated position to the retracted position and/or while transitioning from the retracted position to the elevated position.

 As depicted, the rotational input 308 may be a gear (*e.g.*, cog, spline, helical gear,
20 tapered gear, *etc.*). In some embodiments, the rotational input 308 may remain disengaged when the card input area 202 is not in the retracted position. For example, the rotational input 308 may engage a rotational drive 502 (FIG. 5) (*e.g.*, actuation system, motor and input gear, gearbox, clutch, electronic spindle, *etc.*) at the retracted position where the rotational drive 502 (FIG. 5) may drive the rotational input 308 rotating the card input
25 area 202.

 In other embodiments, the rotational input 308 may be remain engaged (*e.g.*, be permanently engaged) with a gearbox configured to input rotation into the rotational input 308 in the elevated position, the retracted position or at any point during the transition between the elevated position and/or the retracted position.

30 In other embodiments, the rotational input 308 may include any type of linkage. For example, the rotational input 308 may be formed as a shaft (*e.g.*, a keyed shaft) with one or more discontinuous sides (*e.g.*, linear sides) that may engage with a complementary opening to link the shaft to the rotational drive 502. In this and other embodiments, the

- 13 -

linkage of the rotational input 308 may engage and disengage from the rotational drive 502 or may remain constantly engaged.

FIG. 4 shows an elevational side view of the card-handling device 100 with the card intake area 202 in a retracted position within the card-handling device 100. In some embodiments, the card intake area 202 may rotate such that, in the retracted position, the sidewalls 206a, 206b are in a front and back location relative to the card-handling device 100. For example, the card intake area 202 may rotate at least 90°, such as, for example, $\pm 90^\circ$, $\pm 270^\circ$ as the card intake area 202 retracts into the retracted position and/or after the card intake area 202 is in the retracted position. In some embodiments, when the card intake area 202 is in the retracted position the card intake area 202 may be integrated into the card input portion 110. In some embodiments, the card input portion 110 may include a first card feed system 402 configured to transport the playing cards from the card intake area 202 to the card-shuffling apparatus 114.

The playing cards may exit the card intake area 202 through the one of the gaps 302 (FIG. 3) in the sidewalls 206a, 206b (e.g., the gap 302 facing a first card feed system 402 leading to a shuffling apparatus). The card intake area 202 may rotate at least 180° after one or more playing cards are removed from the card intake area 202, altering which sidewall 206a, 206b and corresponding gap 302 is facing the first card feed system 402. For example, a selected number of playing cards may be removed from the card intake area 202 through the gap 302 in sidewall 206a. After the one or more playing cards are removed from the card intake area 202, the card intake area 202 may rotate 180° such that sidewall 206b is facing the first card feed system 402. When the sidewall 206b is facing the first card feed system 402, an additional card or cards may be removed through the gap 302 in the sidewall 206b. As discussed below in greater detail, such a configuration may be utilized to at least partially randomize a side or edge of the cards as they appear on one side of a group of cards (e.g., a leading edge of the card that is visible to players as it protrudes out of a card shoe).

FIG. 5 is an elevational side section view of the card-handling device 100 with both the card intake area 202 and the card outlet 204 in the elevated position. As depicted, the rotational drive 502 for the card intake area 202 may remain integral to the other components of the card input portion 110, such as the first card feed system 402. The rotational drive 502 may only engage the rotational input 308 when the card intake area 202 is in the retracted position. In some embodiments, the first card feed system 402

- 14 -

may be substantially aligned in a substantially horizontal plane. For example, the playing cards may exit the card intake area 202 in a substantially horizontal plane and may continue through the first card feed system 402 and into the card-shuffling apparatus 114 in the same substantially horizontal plane.

5 FIG. 6 shows an enlarged view of the card input portion 110 from the side section view of the card-handling device 100. The card input portion 110 may include the first card feed system 402, a first frame assembly 602, a card-imaging system 604, and one or more sensors 606. The first card feed system 402 may include a first card pathway 608 (*e.g.*, pathway along which playing cards move through the card input portion 110). The
10 first card pathway 608 may lead from the card intake area 202 of the card input portion 110 to the card-shuffling apparatus 114 (*e.g.*, a carousel). The first card feed system 402 may include a set of pick-off rollers 610 that may transport playing cards individually from the card intake area 202 to the first card pathway 608 in a direction indicated by arrow 612. In some embodiments, the pick-off rollers 610 may protrude through the at least one aperture
15 304 (FIG. 3) in the bottom wall 206e of the card intake area 202. The pick-off rollers 610 may remove the playing cards individually from a bottom area of the card intake area 202 through the gaps 302 (FIG. 3) in the sidewalls 206a, 206b. Additional pairs of rollers 614a, 614b, 616a, 616b, 618a, 618b, 620a, and 620b may act to displace playing cards from the card intake area 202 to the card-shuffling apparatus 114 (*e.g.*, one card at a time). For
20 example, a stack of unshuffled playing cards may be placed in the card intake area 202, and the set of pick-off rollers 610 of the first card feed system 402 may remove playing cards (*e.g.*, individually) from a bottom of (*e.g.*, beneath) the stack of unshuffled playing cards and pass the playing cards to the additional pairs of rollers 614a, 614b, 616a, 616b, 618a, 618b, 620a, and 620b, some of which may be brake rollers. The additional pairs of rollers
25 614a, 614b, 616a, 616b, 618a, 618b, 620a, and 620b may transport the playing cards to the card-shuffling apparatus 114. As discussed above, the card intake area 202 may be configured to receive one or more decks of playing cards (*e.g.*, one, two, four, six, eight, ten decks of cards, *etc.*) at a time.

 In some embodiments, the card-imaging system 604 may be oriented along the first
30 card pathway 608 of the first card feed system 402. The first card feed system 402 may transport playing cards past the card-imaging system 604, and the card-imaging system 604 may capture identifying information of each playing card as each playing card moves along the first card pathway 608 before insertion into the card-shuffling apparatus 114. For

- 15 -

example, the card-imaging system 604 may include a camera or line scanning device that captures an image or scan of each card. In some embodiments, the card-imaging system 604 may comprise one or more of the imaging devices described in U.S. Pat. No. 7,933,448 to Downs, issued Apr. 26, 2011, in U.S. Pat. No. 7,764,836 to Downs et al.,
5 issued Jul. 27, 2010, or in U.S. Pat. No. 8,800,993 B2 to Blaha et al., issued Aug. 12, 2014, the disclosure of each of which is incorporated herein in its entirety by this reference. In some embodiments, the card-imaging system 604 may not need to capture an image of an entire card, but may detect only rank and suit information, indicia (*e.g.*, markings) on the playing cards, such as, for example, a lot number, a casino identifier, a shoe number, a shift
10 number, a table number, bar code, glyph, any other known type of special marking, or combinations thereof. In some embodiments, the control system 104 (FIG. 1) of the card-handling device 100 may receive signals from the card-imaging system 604 to determine rank and/or suit of each playing card being read or sensed by the card-imaging system 604. The control system 104 (FIG. 1) of the card-handling device 100 may store at least some
15 data related to each playing card (*e.g.*, an inventory of the playing cards handled by the card-handling device 100, a complete card set composition, *etc.*) in a memory portion of the control system 104 (FIG. 1). Stored data may be compared to data collected at the card-imaging system 604 or another location in the card-handling device 100. For example, the card-imaging system 604 may be used in conjunction with a second card-
20 imaging system that may capture the same information in another location (*e.g.*, the card-shuffling apparatus 114, an associated card-dispensing device, such as a shoe) or with stored values from a previous imaging event to keep an inventory of the playing cards and/or verify the constitution of a group of cards.

In some embodiments, the one or more sensors 606 of the card input portion 110
25 may be oriented proximate the card intake area 202 and may be used to sense whether playing cards are present in the card intake area 202 or whether playing cards are being passed from the card intake area 202 to the first card pathway 608. Furthermore, the sensor 606 may be configured to send signals to the control system 104 (FIG. 1) and inform the control system 104 (FIG. 1) that playing cards are present in the card intake
30 area 202. Furthermore, the control system 104 (FIG. 1) may be configured to initiate a shuffling cycle (*e.g.*, process of shuffling playing cards with the card-handling device 100) when the card intake area 202 is in the retracted position and the sensor 606 detects the

- 16 -

presence of cards in the card intake area 202. In some embodiments, the sensor 606 may include at least one of an optical sensor and an infrared sensor.

In some embodiments, the card input portion 110 may include a restricted portion 650 of the first card pathway 608. For example, the restricted portion 650 may restrict a lateral and/or longitudinal dimension of the card pathway 608 in order to restrict unwanted movement (*e.g.*, bending) of the cards as they moved toward and into the card-shuffling apparatus 114.

In some embodiments, the card input portion 110 may include an elongated packer arm 622. The elongated packer arm 622 may rotate about a packer arm shaft 624 and a pushing surface 626 of a pusher arm 628 of the elongated packer arm 622 may translate partially along the first card pathway 608 of the first card feed system 402 to ensure proper loading of the playing cards into the card-shuffling apparatus 114. A motor 630 may rotate an eccentric cam member 632, which may, cause the elongated packer arm 622 to rock back and forth along an arc-shaped path through a connector link 634.

In some embodiments, the elongated packer arm 622 may be used to provide additional force to a playing card along the first card pathway 608 as the playing card leaves the pair of rollers 620a, 620b. For example, the elongated packer arm 622 may be located in the card-handling device 100 such that the pushing surface 626 of the pusher arm 628 of the elongated packer arm 622 may abut against a trailing edge of a playing card and force the playing card at least substantially completely into the card-shuffling apparatus 114. In some embodiments, the elongated packer arm 622 may be similar to the devices disclosed in the aforementioned U.S. Pat. No. 6,659,460, U.S. Pat. No. 7,766,332, and U.S. Pat. No. 8,800,993 B2, the disclosures of each of which are incorporated herein in their entireties by this reference.

FIG. 7 shows an enlarged view of the card-shuffling apparatus 114 from the cross-sectional side view of the card-handling device 100 of FIG. 5. In some embodiments, the card-shuffling apparatus 114 may include a multi-compartment carousel 702 and the packer arm 622. The multi-compartment carousel 702 may be circular in shape (*e.g.*, annular). The multi-compartment carousel 702 of the card-shuffling apparatus 114 may have a number of compartments 704 (*e.g.*, apertures, securing portions, *etc.*) defined between spaced pairs of adjacent fingers 706 (*e.g.*, adjacent arms, *etc.*) extending from a rotatable center member 708. Each compartment 704 may be defined between two spaced pairs of adjacent fingers 706 of the multi-compartment carousel 702. The fingers 706 may

- 17 -

each include a beveled edge 710 that enables and guides insertion of playing cards on top of or below playing cards previously deposited in the compartments 704 by the first card feed system 402 (FIG. 6) of the card input portion 110. The beveled edges 710 may include flat, angled surfaces or curved surfaces. Card edges of playing cards may contact the beveled edges 710 and may be deflected and guided into the compartments 704.

In some embodiments, the adjacent fingers 706 may include a biasing element (*e.g.*, spring, leaf spring, inverted spring, inverted leaf spring, resilient member, *etc.*) providing biasing pressure between the adjacent fingers 706 for assisting in holding playing cards securely within the compartments 704 after the playing cards are inserted into the multi-compartment carousel 702. In some embodiments, each compartment 704 may be sized and shaped to hold between one and ten playing cards, such as between two and seven playing cards, between one and five playing cards or between four and five playing cards.

In some embodiments, the multi-compartment carousel 702 may have between about eighty or one-hundred compartments and about two-hundred compartments, such as between about one-hundred compartments and about one-hundred-sixty compartments, between about one-hundred-twenty compartments and about one-hundred-forty compartments, or about one-hundred-thirty compartments. In some embodiments, the multi-compartment carousel 702 may be configured to hold up to six-hundred-fifty individual cards, such as between about fifty cards and about six-hundred-fifty cards, between about five-hundred cards and about six-hundred cards, or about five-hundred-twenty cards.

In some embodiments, the compartments 704 may be modular. For example, the multi-compartment carousel 702 may be defined by a number of compartment modules 712 extending radially from the rotatable center member 708. In some embodiments, the compartment modules 712 may be individually removable from the rotatable center member 708. For example, each compartment module 712 may be secured to the rotatable center member 708 with hardware (*e.g.*, screws, bolts, nuts, studs, pins, *etc.*), clamps (*e.g.*, toggle clamps, latch clamps, spring clamps, screw clamps, *etc.*), or latches (*e.g.*, draw latch, pin and tube latch, toggle latch, barrel latch, rotary latch, *etc.*).

The compartment modules 712 may be coupled to center member 708 by one or more fasteners 714 (*e.g.*, bolts, screws, *etc.*). In some embodiments, the compartment modules 712 may include one or more adjustment features 716 that may be utilized to alter the orientation of the compartment modules 712 relative to adjacent compartment

- 18 -

modules 712 and/or relative to the center member 708. For example, the compartment modules 712 may include two adjustment features 716 (e.g., two screws) that alter the orientation of the compartment modules 712 relative to the center member 708 by contacting the center member 708 and pushing the compartment modules 712 in one or more directions. Such adjustment features 716 may be utilized to align each compartment module 712 relative to adjacent compartment modules 712 along the circumference of the multi-compartment carousel 702 (e.g., axially align the compartment modules).

FIG. 8 shows an enlarged view of a compartment module 712 of the multi-compartment carousel 702 of FIG. 7. In some embodiments, the compartment module 712 may include at least one aperture 804 defined between at least two arms 806. In some embodiments, the arms 806 may have a beveled leading edge 810 configured to guide playing cards into the apertures 804 between the arms 806.

In some embodiments, the arms 806 may include a biasing element 814 configured to secure the playing cards within the apertures 804. In some embodiments, the biasing element 814 may be formed from a resilient material configured to bow at least partially outward from the arm 806 intruding into the aperture 804. For example, the biasing element 814 may be a length of resilient material forming an arc with an apex 816 of the arc located within the aperture 804 in a direction away from the arm 806. In some embodiments, the biasing element 814 may be separate from the arm 806. The arm 806 may include a bottom retention 818 and a top retention 820 configured to retain the ends 822 of the biasing element 814. In some embodiments, the biasing element 814 may be a resilient material spanning between the top retention 820 and the bottom retention 818. In some embodiments, at least one of the top retention 820 and the bottom retention 818 may be configured to provide a floating retention of the biasing element 814 such that an end of the biasing element 814 may move relative to the arm 806. For example, the distal end 822 of the biasing element 814 may move inward away from the aperture 804 while still being restricted from moving outward into the aperture 804 beyond a selected distance. When the biasing element 814 is fully extended such that an apex 816 of the biasing element 814 is the largest distance from the arm 806, as permitted by the arms 806, the distal end 822 may be in a first position within the top retention 820. When playing cards are inserted into the aperture 804, the apex 816 may move toward the arm 806 and the floating retention in the top retention 820 may allow the distal end 822 of the biasing element 814 to move to a second position.

- 19 -

In some embodiments, at least one of the bottom retention 818 and the top retention 820 may be a fixed connection such that an end of the biasing element 814 in the bottom retention 818 and/or the top retention 820 may not be allowed to move relative to the arm 806. In some embodiments, the biasing element 814 may be integral to the arm 806 (*e.g.*, formed from the same piece of material such that there is no definitive joint between the biasing element 814 and the arm 806) at the fixed connection. In some embodiments, the biasing element 814 may be formed from a different material and fixed to the arm 806 at the bottom retention 818 and/or the top retention 820. The biasing element 814 may be attached with hardware (*e.g.*, pin, screw, bolt, *etc.*), adhesive (*e.g.*, glue, epoxy, *etc.*), welding, soldering, or brazing.

In some embodiments, one of the bottom retention 818 and the top retention 820 may be a fixed connection while the other retention 818, 820 is a floating retention. For example, the bottom retention 818 may be a fixed connection and the top retention 820 may be a floating retention.

In some embodiments, the biasing element 814 may include a biasing support 830 (*e.g.*, secondary biasing element, secondary spring, bump stop, damper, *etc.*). For example, the biasing support 830 may be positioned between the apex 816 and the arm 806. The biasing support 830 may be configured to provide additional support to the biasing element 814. In some embodiments, the biasing support 830 may be adjustable such that the securing pressure of the biasing element 814 and/or the biasing support 830 may be adjustable, such as, for example, by limiting the travel of the biasing element 814, increasing the resistance by preloading the biasing support (*e.g.*, spring spacers, indexed seats, *etc.*), and/or otherwise altering the resistance of the biasing support (*e.g.*, fluid pressure, damper valve adjustments, *etc.*). In some embodiments, the biasing support 830 may be a coil spring. In some embodiments, the biasing element 814 and/or the arm 806 may include seats 832 to locate or restrict movement of the biasing support 830 in at least one direction (*e.g.*, in a lateral or axial direction). For example, the seats 832 may be pins and the biasing support 830 may define complementary geometry (*e.g.*, hole, aperture, annular formation, *etc.*) to the pins such that the biasing support 830 is secured between the biasing element 814 and the arm 806.

In some embodiments, the apertures 804 may each include a sensor to determine when the aperture 804 is full (*e.g.*, has the maximum number of playing cards it is configured to hold by sensing the position of the biasing element 814). In some

- 20 -

embodiments, the sensor may include a pair of contacts, a magnetic switch, reed switch, pressure switch, proximity switch, *etc.* In some embodiments, the control system 104 (FIG. 1) may track the number of cards loaded into each aperture 804 and determine which apertures 804 are full based on the tracking information.

5 In some embodiments, the control system 104 (FIG. 1) may control which aperture 804 receives the playing cards and may determine which apertures 804 are full and which apertures 804 can receive playing cards. In some embodiments, the control system 104 may trigger the ejection of playing cards into the card output portion 112 (FIG. 2) responsive to information obtained and/or stored by the control system 104 (*e.g.*, a
10 record of where cards have been loaded in a shuffling event, input from the sensors, *etc.*). For example, the control system 104 (FIG. 1) may trigger the ejection based on a percentage of full apertures 804. In some embodiments, the control system 104 (FIG. 1) may trigger the ejection responsive to a number of full apertures 804, such as between about one-hundred full apertures 804 and about two-hundred full apertures 804, between
15 about one-hundred twenty full apertures 804 and about one-hundred-thirty full apertures 804, or about one-hundred-twenty-five full apertures 804. In some embodiments, the control system 104 (FIG. 1) may only trigger the ejection when every aperture 804 is full. In some embodiments, the control system 104 (FIG. 1) may trigger an ejection only from an aperture 804 that is full, resulting in ejection of cards only from full apertures 804.

20 Although the card-handling device 100 of the present disclosure describes the card-shuffling apparatus 114 including a multi-compartment carousel 702, the card-shuffling apparatus 114 may include any suitable shuffling mechanism such as, for example, those disclosed in U.S. Pat. No. 5,676,372 to Sines et al. that issued Oct. 14, 1997, U.S. Pat. No. 6,254,096 to Grauzer et al. that issued Jul. 3, 2001, U.S. Pat. No. 6,651,981 to Grauzer et
25 al. that issued Nov. 25, 2003, and U.S. Pat. No. 6,659,460 to Blaha et al. that issued Dec. 9, 2003, the disclosures of each of which are incorporated herein in their entireties by this reference. In some embodiments, the card-shuffling apparatus 114 may have a wheel or carousel design that may be somewhat similar to the card-shuffling devices disclosed in the aforementioned and incorporated by reference U.S. Pat. No. 8,800,993 B2.

30 In some embodiments, the card-shuffling apparatus 114 may operate, in at least one operational mode, as a continuous shuffling machine. In other words, the card-shuffling apparatus 114 may be configured to continuously receive cards (*e.g.*, after each round of play) and may continuously shuffle cards and provide cards to the dealer without unloading

- 21 -

unused cards. In contrast, batch shuffling the one or more decks of cards involves unloading the entire set of cards after each shuffling cycle. For example, the card-shuffling apparatus 114 may shuffle the playing cards such that playing cards discarded and reinserted into the card-handling device 100 from a previous round have a chance of
5 appearing (*e.g.*, being dealt) in the next round.

In some embodiments, the card-shuffling apparatus 114 may operate, in at least one operational mode, as a batch shuffling machine or to verify and/or sort a group or deck of playing cards. For example, the card-shuffling apparatus 114 may be configured to shuffle a complete set or “shoe” of one or more decks of cards (*e.g.*, one, two, four, six, eight, ten
10 decks of cards, *etc.*) and then provide the cards from those decks to the dealer (*e.g.*, one card at a time, one hand at a time, *etc.*) until the set of cards is depleted, or a cut card is reached.

Referring to FIGS. 4, 5, and 8, in some embodiments, the card-handling device 100 (*e.g.*, via the capacity of multi-compartment carousel 702) may enable a sorting operation
15 that may be performed even when a relatively large amount of cards (*e.g.*, six decks, eight decks, ten decks, twelve decks, variations in between, or more decks of cards) are required to be sorted in the card-handling device 100. For example, the card-handling device 100 may identify and load one or more cards in each compartment 704 (*e.g.*, one to two, three, four, five, or more cards). As one or more cards are placed in a compartment 704, the next
20 card received (*e.g.*, from the card intake area 202) may be placed in the currently aligned compartment 704, if the card fits the desired sorting sequence (*e.g.*, a sequence each deck by rank and suit). If the card does not fit the desired sequence in the currently aligned compartment 704, the carousel 702 may be moved to align a compartment 704 including a card or cards that meet the desired sorting sequence or to align a new compartment lacking
25 any cards in order to load the current card from the card intake area. In some embodiments, during the sorting process, the card-handling device 100 may offload any compartments 704 that contain cards the match the desired sequence of the cards in the card outlet 204 so that those compartment may again be utilized for new cards in the sorting. This process may continue until all cards are sorted and delivered to the card
30 outlet 204.

If the sort was not able to be completed in a single pass (*e.g.*, by running out of compartments 704), the card-handling device 100 may output the cards to card outlet 204

- 22 -

to be reloaded in the card intake area 202 so that the sort may be completed in a second pass.

FIG. 9 shows an enlarged view of the card output portion 112 of the card-handling device 100 (FIG. 1). A card transfer system 902 of the card-shuffling apparatus 114 may transfer playing cards from the multi-compartment carousel 702 to the card outlet 204 of the card output portion 112 of the card-handling device 100 along a second card pathway 903 when the card outlet 204 is in the retracted position. In some embodiments, the multi-compartment carousel 702 may include an ejector 904. The ejector 904 may be configured to unload the cards from the compartments 704 into the card transfer system 902. The ejector 904 may be configured to unload the compartments 704 in a compartment 704 by compartment 704 manner. For example, the ejector 904 may unload a first compartment 704 completely before unloading a second compartment 704. In some embodiments, the second compartment 704 may be a compartment 704 adjacent to the first compartment 704. In other embodiments, the second compartment 704 may be a randomly selected compartment 704 and may not be a compartment 704 adjacent to the first compartment 704. In some embodiments, the ejector 904 may not unload the compartments 704 compartment 704 by compartment 704 rather, the ejector 904 may unload playing cards from the compartments 704 in a randomized (*e.g.*, non-sequential) order. For example, the ejector 904 may unload one or more playing cards from a first compartment 704 without unloading other playing cards in the first compartment 704 and then may unload one or more playing cards from a second compartment 704 (*e.g.*, with or without unloading other playing cards in the second compartment 704). In some embodiments, the ejector 904 may unload the playing cards one-at-a-time. In other embodiments, the ejector 904 may unload multiple playing cards at a time.

In some embodiments, the ejector 904 and the card transfer system 902 may be located at a top portion of the multi-compartment carousel 702. For example, the ejector 904 may unload playing cards into the card transfer system 902 when the compartment 704 retaining the playing cards is in a substantially vertical orientation within the multi-compartment carousel 702. In some embodiments, the ejector 904 and card transfer system 902 may be located about 90° of rotation about the axis of the multi-compartment carousel 702 from the first card feed system 402 (FIG. 6) such that the cards being unloaded from the compartments 704 are in an orientation transverse to an orientation of the cards when they are inserted into the compartments 704.

- 23 -

In some embodiments, the card transfer system 902 may include a plurality of rollers 906. The rollers 906 may displace playing cards from the multi-compartment carousel 702 to the card outlet 204 along the second card pathway 903. In some embodiments, the card transfer system 902 may include a packer arm 908. The packer arm 908 may include a packer arm pivot 910, an extended arm 912, and a finger 914. For example, the packer arm 908 may be driven by an eccentric packer motor 916 through a connecting link 918. The packer arm 908 may rotate about the packer arm pivot 910 translating the extended arm 912 and the finger 914 partially along the second card pathway 903. In some embodiments, the finger 914 may be configured to engage with a trailing edge of the playing cards to ensure proper loading of the playing cards into the card outlet 204.

The packer arm 908 may be used to provide additional force to a playing card along the second card pathway 903 as the playing card leaves the rollers 906. For example, the packer arm 908 may be located in the card-handling device 100 such that the finger 914 of the extended arm 912 of the packer arm 908 may abut against a trailing edge of a playing card and force the playing card at least substantially completely into the card outlet 204.

As depicted, the card outlet 204 may be configured to store the playing cards 205 in a similar orientation to the orientation in which the cards leave the card-shuffling apparatus 114. The card outlet 204 may be configured to store the playing cards in a substantially horizontal stack, such that the cards are in a vertical orientation (*e.g.*, lateral or longitudinal edges of the cards extend in a substantially vertical direction) with each card stacked horizontally (*e.g.*, where a height of the stack of cards is slanted to extend along a major length of the card output portion 112 in a direction along the top surface 108) next to an adjacent card with the major faces of the cards lying in a plane substantially transverse to the top surface 108. The card outlet 204 may be configured to substantially support the cards on at least two sides of the cards.

As depicted, the card outlet 204 may be configured to elevate and retract above and below the top surface 108 of the card-handling device 100. For example, the card outlet 204 may retract below the top surface 108 of the card-handling device 100 to be in closer proximity to the card-shuffling apparatus 114 while cards are transferred from the multi-compartment carousel 702 to the card outlet 204. In some embodiments, the card outlet 204 may be elevated above the top surface 108 of the card-handling device 100 when it has a complete set of one or more decks of cards (*e.g.*, one, two, four, six, eight, ten decks of

- 24 -

cards, *etc.*) that may be loaded in a card-dispensing device, such as, a card shoe. In some embodiments, the card outlet 204 may be elevated above the top surface 108 of the card-handling device 100 when the operator needs to enter additional cards into gameplay, such as, to load the cards in a card shoe or to deal or draw cards individually or as a group of cards. In some embodiments, the card outlet 204 may remain in the elevated position above the top surface 108 of the card-handling device 100 until the cards have been removed from the card outlet 204.

FIG. 10 shows a close up view of the card outlet 204 of the card-handling device 100. In some embodiments, the card outlet 204 may be configured to hold up to six-hundred fifty cards 205, such as between about fifty cards and about six-hundred-fifty cards, between about five-hundred cards and six-hundred cards, or about five-hundred-twenty cards (*e.g.*, ten decks of cards).

In some embodiments, cards may be provided to the card outlet 204 (*e.g.*, in the retracted position within the card-handling device 100 (FIG. 1)) by the card transfer system 902 (FIG. 9) may be added from an area below the card outlet 204. For example, a portion of the card outlet 204 (*e.g.*, door or gate 1004) may define a card passage 1014 (*e.g.*, opening, slot, *etc.*) in a lower portion of the gate 1004. The card passage 1014 may enable cards to pass through the card passage 1014 from the card transfer system 902 (FIG. 9) into the card outlet 204. In some embodiments, the gate 1004 may further define an angled surface 1008 configured to guide the cards being inserted through the card passage 1014 into the area within the card outlet 204. For example, the angled surface 1008 may provide a surface on which the card may slide to insert the card between a front area of the stack of playing cards 205 within the card outlet 204 and the gate 1004.

In some embodiments, the card outlet 204 may be configured to vary the internal volume of the card outlet 204. For example, the card outlet 204 may include a movable guide 1002. The movable guide 1002 may reduce the internal volume of the card outlet 204 when a number of cards to be placed in the card outlet 204 is, at least initially, less than the full capacity of the card outlet 204. The movable guide 1002 may be retracted to increase the internal volume of the card outlet 204 gradually as cards are loaded into the card outlet 204 to increase the capacity of the card outlet 204.

The card outlet 204 may be configured to present (*e.g.*, release) a predetermined number of cards (*e.g.*, all of the cards) to the operator such that the operator can withdraw (*e.g.*, draw, slide, remove, *etc.*) the cards from the card outlet 204. For example, the card

- 25 -

outlet 204 may include the movable guide 1002 and the gate 1004 on an end of the card outlet 204. In some embodiments, the gate 1004 may be configured to open a specified amount to enable a specific number of cards to be withdrawn past the gate 1004 (*e.g.*, to enable an entirety of the cards 205 to slide over the gate 1004, which is substantially flush with the top surface 108 (FIG. 2) when in the open position). The gate 1004 may include a
5 securing mechanism 1006 (*e.g.*, a magnetic latch and a hinge) to secure the gate 1004 in place when cards are not being withdrawn. For example, a force provided by an operator sliding the cards 205 may overcome the magnetic latch and move the gate into the open, flush position. The operator may then continue sliding the cards 205 over the gate 1004 to
10 the top surface 108 in order to further process the cards 205 (*e.g.*, by cutting the decks of cards, moving the decks of cards into a shoe, *etc.*).

In some embodiments, the movable guide 1002 may be driven by a biasing element (*e.g.*, a spring, compressible fluid, *etc.*). In some embodiments, the movable guide 1002 may be driven by a motor 1010. In some embodiments, the gate 1004 may displace to a
15 position clear of a pathway (*e.g.*, into recess 207 (FIG. 2)) upon which a stack of playing cards 205 travels to exit the card outlet 204. The motor may drive the movable guide 1002 a predetermined distance to push the cards 205 over the open gate 1004 to enable the operator to withdraw the cards. In some embodiments, where the cards 205 are removed in partial groups, the motor 1010 may act as a biasing element maintaining pressure on the
20 movable guide 1002 such that when the gate 1004 opens and cards are withdrawn the movable guide 1002 moves the remaining cards into position for the next withdrawal.

In some embodiments, the motor 1010 may include a slip clutch 1012 (*e.g.*, friction clutch, one way clutch, sprag clutch, freewheel clutch, overrunning clutch, *etc.*) to decrease fatigue on the motor 1010 and other components when running against the closed
25 gate 1004. In some embodiments, the slip clutch 1012 may enable the movable guide 1002 to expand the internal volume of the card outlet 204 in response to additional cards being added by the card transfer system 506 (FIG. 5) without requiring the motor 1010 to drive the movable guide 1002 in the reverse direction.

FIG. 11 shows a flow diagram of a process 1100 in which the card-handling
30 device 100 may transport and shuffle playing cards (*e.g.*, with the control system 104 of the card-handling device 100 controlling the process through one or more executed algorithms executed by one or more processors and/or through one or more random number generators (RNGs)). Referring to FIGS. 1 through 9 and 11 together, unshuffled playing cards may be

- 26 -

loaded into the card intake area 202 of the card input portion 110 of the card-handling device 100, as represented in action 1102. The control system 104 of the card-handling device 100 may rotate the card intake area 202 and the playing cards housed therein such that the lateral edges of the playing cards that face the card-shuffling apparatus 114 may be altered and randomized, as represented in action 1104. For example, the control system 104 of the card-handling device 100 may rotate the card intake area 202 may intermittently rotate the card intake area 202 (e.g., as dictated by an RNG) in order to randomize the lateral edges of the cards in the stack of cards in the card intake area 202 as the cards are loaded into the card-shuffling apparatus 114. The first card feed system 402 may transport at least one playing card from the card intake area 202 to another area (e.g., another portion of the card-handling device, another device, a randomizing mechanism or shuffler, *etc.*), as represented by action 1106. After the at least one playing card is removed from the card intake area 202, the card intake area 202 may rotate the playing cards at least 180° such that an opposite lateral edge of the playing cards is facing the first card feed system 402, as represented in action 1104'. After the card intake area 202 has rotated in action 1104', the first card feed system 402 may transport at least one more playing card from the card intake area 202 to the other area, as represented in action 1106. In some embodiments, the actions 1104, 1104', and 1106 may be repeated (e.g., with one card or multiple cards being transferred in each act) until there are no more playing cards in the card intake area 202. In some embodiments, the actions 1104, 1104', and 1106 may be repeated until the card intake area 202 has been emptied. In some embodiments, the actions 1104, 1104', and 1106 may be repeated until an operator enters a command in the control system 104 to stop the process. Once the playing cards have been transported the playing cards may be presented to the user (e.g., dealer), as represented in action 1108.

FIG. 12 shows a flow diagram of a process 1200 in which the card-handling device 100 may transport and shuffle playing cards. Referring to FIGS. 1 through 9 and 12 together, the card intake area 202 may be elevated above the top surface 108 of the card-handling device 100 to facilitate the loading of unshuffled cards, as represented in action 1202. The operator (e.g., dealer) may then load unshuffled cards into the card intake area 202, as represented by action 1204. In some embodiments, the operator may load unshuffled cards by decks (e.g., 52 cards at a time), or as an entire shoe (e.g., 2 decks, 4 decks, 6 decks, 8 decks, or 10 decks). After the unshuffled cards have been loaded into the

- 27 -

card intake area 202, the card intake area 202 may be retracted below the top surface 108 of the card-handling device 100.

Once the card intake area 202 is fully retracted into the card-handling device 100, the card intake area 202 may rotate until a lateral edge of the playing cards is facing the multi-compartment carousel 702, as represented by action 1208. In other embodiments, the card intake area 202 may be retracted in a position where the a lateral edge of the playing cards is facing the multi-compartment carousel 702 and may not need to be initially rotated before transferring one or more cards. Once a lateral edge of the playing cards is facing the multi-compartment carousel 702, the pick-off rollers 610 may remove at least one card from the card intake area 202, as represented in action 1210. The pick-off rollers 610 may transfer the removed card to the first card feed system 402, which may transport the at least one card from the card intake area 202 to the multi-compartment carousel 702, as represented in action 1212.

The elongated packer arm 622 may move the at least one card from the first card feed system 402 into a compartment 704 of the multi-compartment carousel 702, as represented in action 1214. The multi-compartment carousel 702 may rotate moving the compartment 704 with at least one card in it to another location and presenting a new compartment 704 in the area of the elongated packer arm 622, as represented in action 1216. In some embodiments, the multi-compartment carousel 702 may rotate after each card is placed into a compartment 704. In some embodiments, the multi-compartment carousel 702 may only rotate after the compartment 704 is full. In some embodiments, the multi-compartment carousel 702 may rotate at random times (*e.g.*, sometimes taking one card in each compartment 704 and other times taking more than one card in the compartment 704 before rotating). For example, the control system 104 may select a compartment 704 in which to load a card based on output from an RNG. If the selected compartment 704 has already reached a selected number of card in the compartment 704 (*e.g.*, the compartment is full), the control system 104 may select another compartment 704 using the RNG or through another predetermined method.

In some embodiments, the multi-compartment carousel 702 may rotate the same number of compartments 704 (*e.g.*, 2 compartments, 3 compartments, *etc.*) during each rotation. In some embodiments, the control system 104 may randomize the number of compartments 704 that the multi-compartment carousel 702 rotates through each time it rotates.

- 28 -

After the at least one card is removed in action 1210, the card intake area 202 may rotate at least 180° such that the opposite lateral edge of the unshuffled cards is facing the multi-compartment carousel 702, as represented in action 1208'. After the card intake area 202 is rotated in action 1208', the pick-off rollers 610 may remove at least one card

5 from the card intake area 202, as represented in action 1210'. The removed card may be transported through the first card feed system 402 and be inserted into a compartment 704 of the multi-compartment carousel 702, as represented in actions 1212 and 1214. The multi-compartment carousel 702 may continue to rotate as described above and represented in 1216. This process may continue to repeat until there are no more cards in the card

10 intake area 202, until a preselected is reached, or until the operator enters a command to stop the process. Such a process performed by the control system 104 of the card-handling device 100 may enable an operator to randomize (e.g., intermittently alter, sporadically alter) which lateral edge of the cards is presented on one side of a stack (e.g., deck(s)) of cards.

15 The ejector 904 may eject the cards from the compartments 704 of the multi-compartment carousel 702 into the card transfer system 902, as represented in action 1218. The card transfer system 902 may transfer the card to the card outlet 204, as represented in action 1220. The cards may be inserted into the card outlet 204 with major faces of the cards aligned at least partially in a substantially vertical plane (e.g., transverse to the top

20 surface 108 of the card-handling device 100, where the stack of cards is tipped over primarily extending in a horizontal or lateral plane). In some embodiments, the card outlet 204 may be positioned above the top surface 108 of the card-handling device 100. In some embodiments, the card outlet 204 may elevate and retract similar to the card intake area 202. For example, the card outlet 204 may be in a retracted position when the cards

25 are inserted into the card outlet 204 in action 1220. In some embodiments, the card outlet 204 may be elevated above the top surface 108 of the card-handling device 100 when the card outlet 204 is full to facilitate access to the shuffled cards 205 by the operator. In some embodiments, the card outlet 204 may elevate once a specified number of cards are inserted into the card outlet 204. In some embodiments, the card outlet 204 may remain in

30 the retracted position until the operator enters a command into the control system 104 to call the card outlet 204 to the area above the top surface 108 of the card-handling device 100.

- 29 -

The embodiments of the present disclosure may facilitate implementation and practice of card games using larger numbers of cards than is conventionally possible without undesirably delaying game play. For example, the embodiments of the present disclosure may allow for the card games using more than eight decks of cards, such as, for
5 example, ten decks of cards, or twelve decks of cards. Embodiments of the card-handling devices may also facilitate simple repair and replacement of wear parts of the card-handling device, such as, for example, compartment modules of the multi-compartment carousel, roller, imaging devices, and sensors by enabling access to these components that can be removed (*e.g.*, where select groups of compartments of the carousel may be
10 individually removed and repaired or replaced).

The embodiments of the present disclosure may reduce and/or eliminate the effectiveness of some forms of card manipulating or counting. For example, embodiments of the present disclosure may reduce or eliminate the effectiveness of card manipulating or counting methods involving edge sorting by randomizing the orientation of the lateral
15 edges of the cards within the card-handling device. Further, the ability of the card-handling device may enable the use of more decks and thus reduce and/or eliminate the effectiveness of some forms of card manipulating or counting. Similarly, increasing the number of cards in a cut may also reduce and/or eliminate the effectiveness of some forms of card manipulating or counting.

20 The embodiments of the disclosure described above and illustrated in the accompanying drawings do not limit the scope of the disclosure, which is encompassed by the scope of the appended claims and their legal equivalents. Any equivalent embodiments are within the scope of this disclosure. Indeed, various modifications of the disclosure, in addition to those shown and described herein, such as alternate useful combinations of the
25 elements described, will become apparent to those skilled in the art from the description. Such modifications and embodiments also fall within the scope of the appended claims and equivalents.

- 30 -

CLAIMS

What is claimed is:

- 5 1. A card-handling device, comprising:
a playing card-shuffling apparatus; and
a card rotation device configured to rotate one or more playing cards about a minor axis of the
one or more playing cards to randomly alter an orientation of lateral edges of the one
or more playing cards, the minor axis of the one or more playing cards extending
10 through a thickness of the at one or more playing cards in a direction transverse to a
longitudinal axis and a lateral axis of the one or more playing cards as at least one of
the one or more playing card enters the card-shuffling apparatus.
- 15 2. The card-handling device of claim 1, wherein the card rotation device
comprises a card input of the card-handling device.
- 20 3. The card-handling device of claim 1, wherein the card-handling device is
configured to position the card rotation device in a first orientation with first lateral edges of
the one or more playing cards facing the card-shuffling apparatus and a second orientation
20 with second lateral edges of the one or more playing cards facing the card-shuffling apparatus,
the first lateral edges opposing the second lateral edges.
- 25 4. The card-handling device of claim 3, wherein the first lateral edges and the
second lateral edges extend along longitudinal axes of the one or more playing cards.
- 30 5. The card-handling device of claim 3, wherein the second orientation is
approximately 180° of rotation different from the first orientation.
- 30 6. The card-handling device of claim 3, further comprising an actuation system
associated with the card rotation device and a frame structure of the card-handling device, the
actuation system configured to move the card rotation device between the first orientation and
the second orientation.

- 31 -

7. The card-handling device of claim 6, wherein the actuation system is configured to automatically rotate the card rotation device approximately 180° between the second orientation and the first orientation.

5 8. The card-handling device of claim 1, further comprising a card output comprising a card output area configured to receive playing cards from the card-shuffling apparatus, wherein the card output is configured to present the playing cards in a horizontal orientation with major faces of the playing cards extending a direction transverse to a gaming surface on which the card-handling device is utilized.

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9. The card-handling device of claim 8, wherein the card-shuffling apparatus comprises a carousel configured to receive and eject the playing cards from a number of compartments arranged radially about the carousel.

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10. The card-handling device of claim 9, wherein the number of compartments comprise at least 100 compartments.

11. The card-handling device of claim 9, where the carousel comprises compartment modules each comprising at least two compartments, wherein each compartment
20 module is configured to be individually removed from and positioned in the carousel, the compartment modules collectively comprising the number of compartments.

12. The card-handling device of claim 11, wherein the compartment modules each comprise at least four compartments and less than ten compartments.

25

13. The card-handling device of claim 11, wherein the carousel is configured to receive the playing cards from the card rotation device in a compartment at a first position and eject the playing cards from the compartment into the card output area at a second position, wherein the second position is approximately 90° of rotation from the first position.

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- 32 -

14. The card-handling device of claim 13, wherein the playing cards are received into the card output area in an orientation substantially transverse to an orientation in which the playing cards are received into the card-handling device in a card input of the card-handling device.

5

15. A card-handling device, comprising:
a card input configured to rotate at least one playing card of a group of playing cards about a minor axis of the at least one playing card to alter an orientation of lateral edges of the at least one card relative to at least one adjacent playing card of the group of playing cards, the minor axis of the at least one playing card extending through a thickness of the at least one playing card in a direction transverse to a longitudinal axis and a lateral axis of the at least one playing card, wherein the card input is configured to enable the at least one playing card to be provided to a card-shuffling apparatus for shuffling playing cards after the orientation of the lateral edges of the at least one playing card has been altered.

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16. A card-handling device configured to be mounted at or proximate a gaming surface, the card-handling device comprising:
a card-shuffling apparatus for shuffling playing cards; and
a card rotation device configured to receive the playing cards in a substantially flat orientation and to alter an orientation of a leading edge of at least some of the playing cards while maintaining the at least some of the playing cards in the substantially flat orientation.

20

17. The card-handling device of claim 16, wherein the card-handling device is configured to transfer the playing cards to the card-shuffling apparatus after the orientation of the leading edge of at least some of the cards have been altered by the card rotation device.

25

18. The card-handling device of claim 16, further comprising a card output area for receiving the playing cards from an output of the card-shuffling apparatus, wherein the card output area is configured to receive and store the playing cards in an orientation where major faces of the playing cards are substantially transverse to the gaming surface.

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- 33 -

19. The card-handling device of claim 18, wherein the card output area is configured to hold between five-hundred and six-hundred playing cards in a single stack where the playing cards are substantially supported on sides of each of the playing cards.

5 20. The card-handling device of claim 16, wherein the card rotation device comprises:
a rotating elevator configured to receive the playing cards with major faces of the playing
cards in a plane substantially parallel to the gaming surface and rotate the playing
cards at least 90° in the plane substantially parallel to the gaming surface, and transport
10 the playing cards from a first position above the card-handling device to a second
position within the card-handling device;
a first card feed system for transporting the playing cards from the rotating elevator in an area
below the gaming surface to the card-shuffling apparatus, the first card feed system
comprising a first card pathway; and
15 an imaging system oriented along the first card pathway of the first card feed system
configured to read at least one indicia of the playing cards being transported along the
first card pathway of the first card feed system.

21. A card-handling device configured to be positioned at a gaming structure
20 having a playing surface, comprising:
a card-shuffling apparatus for shuffling playing cards; and
a card output portion for receiving the playing cards from the card-shuffling apparatus,
wherein the playing cards are positioned by the card-shuffling apparatus to be
received into the card output portion where major faces of the playing cards are
25 oriented in a plane substantially transverse to the playing surface when the card
output portion is in a first position at least partially within the card-handling device,
and where the card output portion is further configured to transport the playing
cards to a second position where at least a portion of the card output portion is
accessible from the playing surface.

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- 34 -

22. The card-handling device of claim 21, wherein the card-handling device is configured to output the playing cards in a stack where a height of the stack of the playing cards is slanted to extend along a major length of the card output portion in a direction along the playing surface.

5

23. The card-handling device of claim 21, further comprising a rotating card input device, wherein the rotating card input device is configured to:
receive the playing cards in a plane substantially parallel to the playing surface,
rotate the playing cards within the plane substantially parallel to the playing surface, and
10 transport the playing cards as rotated to the card-shuffling apparatus.

24. The card-handling device of claim 21, wherein the card output portion enables an operator to slide a stack of the playing cards from the card output portion onto the playing surface when the card output portion is in the second position.

15

25. The card-handling device of claim 21, wherein the card output portion comprises:
a storage compartment configured to hold the playing cards in a plane substantially parallel
to the playing surface; and
20 a movable guide configured to alter a volume of the storage compartment.

26. The card-handling device of claim 25, wherein the card output portion comprises a door on an end of the storage compartment configured to release a selected number of cards.

25

27. The card-handling device of claim 26, wherein the door comprises a magnetic securing device, and wherein the door is configured to displace to a position clear of a pathway upon which a stack of playing cards travels to exit the storage compartment of the card output portion.

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- 35 -

28. A method of shuffling cards, comprising:
inputting cards into a card rotation device of a card-handling device;
rotating the card rotation device from a first orientation to a second orientation about a minor
axis of the cards to alter an orientation of lateral 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 an orientation of the
lateral edges of the cards;
transporting the cards from the card rotation device into a card-shuffling apparatus;
outputting at least one card from the card-shuffling apparatus into a card output area.

10

29. The method of claim 28, further comprising transporting at least one card
from the card rotation device when the card rotation device is in the second orientation.

30. The method of claim 28, wherein rotating the card rotation device from the
first orientation to the second orientation comprises rotating the card rotation device about
180°.

31. The method of claim 28, further comprising inputting the cards into the card
rotation device in a first plane and outputting the at least one card into the card output area
in a second plane where the second plane is substantially perpendicular to the first plane.

32. A method of shuffling cards comprising:
inputting cards into a card-handling device in an orientation substantially parallel a
horizontal plane;
transporting the cards to a card-shuffling apparatus;
outputting the cards into a card output area in an orientation substantially perpendicular to
the horizontal plane.

33. The method of claim 32, wherein transporting the cards comprises moving
the cards from a location above a surface of a gaming structure to another location below
the surface of the gaming structure, and outputting the cards comprises returning the cards
to the surface of the gaming structure.

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- 36 -

34. The method of claim 33, further comprising sliding cards out of the card output area to the surface of the gaming structure at one time.

35. The method of claim 32, wherein transporting the cards comprises rotating at least some of the cards about a minor axis of the cards to alter an orientation of lateral edges of the at least some 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.

36. A card-handling device comprising:
a card-shuffling apparatus comprising:
a carousel; and
at least one-hundred compartments each configured to hold between one and ten cards arranged radially about the carousel.

37. The card-handling device of claim 36, wherein the compartments comprise an aperture and a securing element.

38. The card-handling device of claim 37, wherein the securing element comprises:
an arm defining a top retention and a bottom retention; and
a leaf spring comprising a resilient material spanning between the bottom retention and the top retention wherein:
the leaf spring has a length greater than a distance between the top retention and the bottom retention;
the leaf spring forms an arc with an apex in a direction away from the arm; and
a connection of the leaf spring to at least one of the top retention or the bottom retention is a floating connection.

39. The card-handling device of claim 36, wherein the carousel comprises compartment modules, each module comprising at least two compartments configured to be individually removed from and positioned in the carousel, the compartment modules collectively comprising the at least one-hundred compartments.

- 37 -

40. The card-handling device of claim 36, wherein the at least one-hundred compartments comprise between one-hundred-twenty and one-hundred-forty compartments.

5

41. A card-shuffling carousel comprising:
compartments configured to hold at least one card arranged radially about the carousel,
wherein the compartments comprise:
an aperture defined by at least two arms; and
10 a resilient material extending between a bottom retention and a top retention in at
least one of the at least two arms, wherein the resilient material has a length
greater than a distance between the bottom retention and the top retention
and at least one of the bottom retention or the top retention comprises a
movable connection.

15

42. The card-shuffling carousel of claim 41, wherein the resilient material is
fixed to at least one of the top retention and the bottom retention.

43. A card-handling device for use with a gaming surface comprising:
20 a retractable card input portion configured to receive playing cards in an orientation
substantially parallel to the gaming surface;
a transportation device configured to transfer the playing cards from the retractable card
input portion to a card-shuffling apparatus within the card-handling device; and
a card outlet configured to receive the playing cards from the card-shuffling apparatus and
25 to deliver the playing cards to a location proximate the gaming surface in an
orientation substantially transverse to the gaming surface.

44. The card-handling device of claim 43, wherein the card outlet is configured
to receive the playing cards from the card-shuffling apparatus at a location below the
30 gaming surface.

- 38 -

45. The card-handling device of claim 44, wherein the card outlet is configured to elevate the playing cards above the gaming surface and maintain the playing cards in the orientation substantially transverse to the gaming surface.

- 5 46. A card-handling device configured to be positioned at least partially below a gaming table upper surface, and comprising:
a card intake area;
a card-shuffling apparatus, the card intake area configured to feed cards into the card-
shuffling apparatus in an orientation substantially parallel to a surface of the gaming
10 table; and
an output area configured to receive the cards from the card-shuffling apparatus in an
orientation substantially transverse to the surface of the gaming table in an area
beneath the surface of the gaming table and to transport the cards to an area at least
partially above the surface of the gaming table.

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