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(54) **TABLE-FLUSH SHUFFLING SYSTEM**

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(57) **ABSTRACT**

A flush-mountable playing card randomization system having a shuffling zone with a playing card insertion area comprising a playing card support surface at a first elevation with respect to a highest level within the randomization system. Associated with the playing card support surface is a playing card mover moving individual playing into a first side of the shuffling zone. There is a randomized playing card collection surface at a second elevation with respect to the randomization system. The collection surface at the second elevation is at least 5 centimeters lower than the playing card support surface, with an exposed or exposable playing card collection area. The system may be retracted to enable manual access.

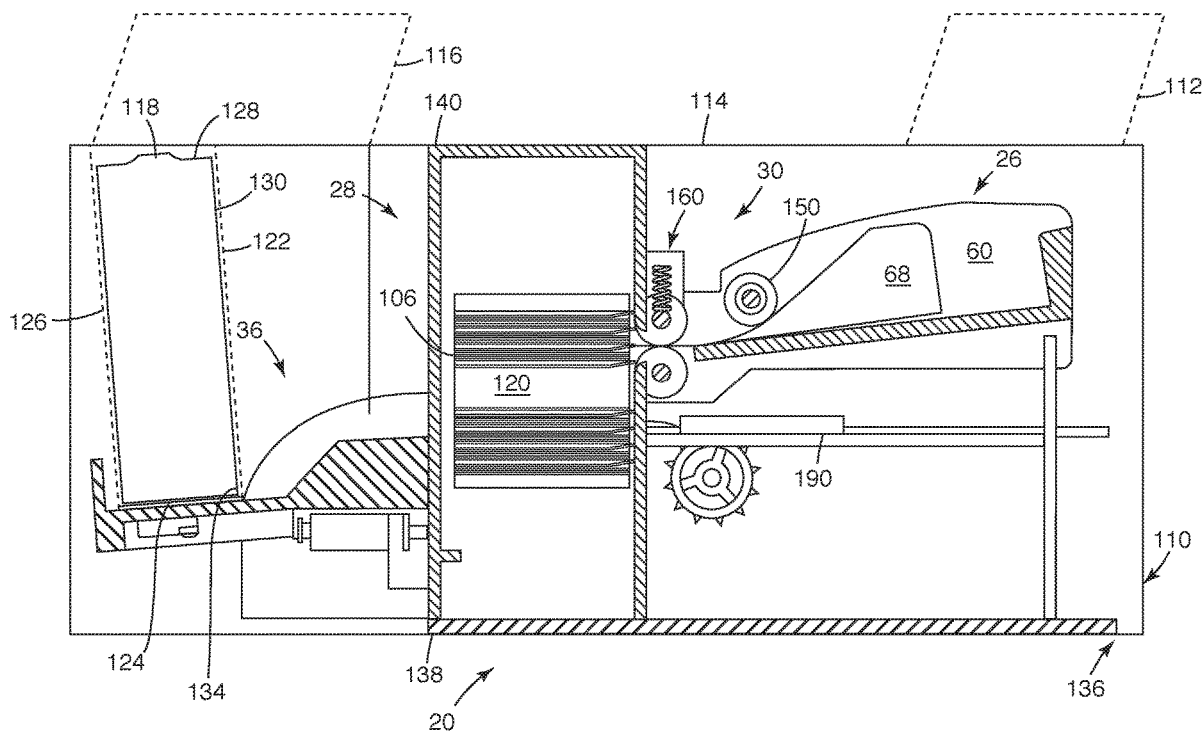
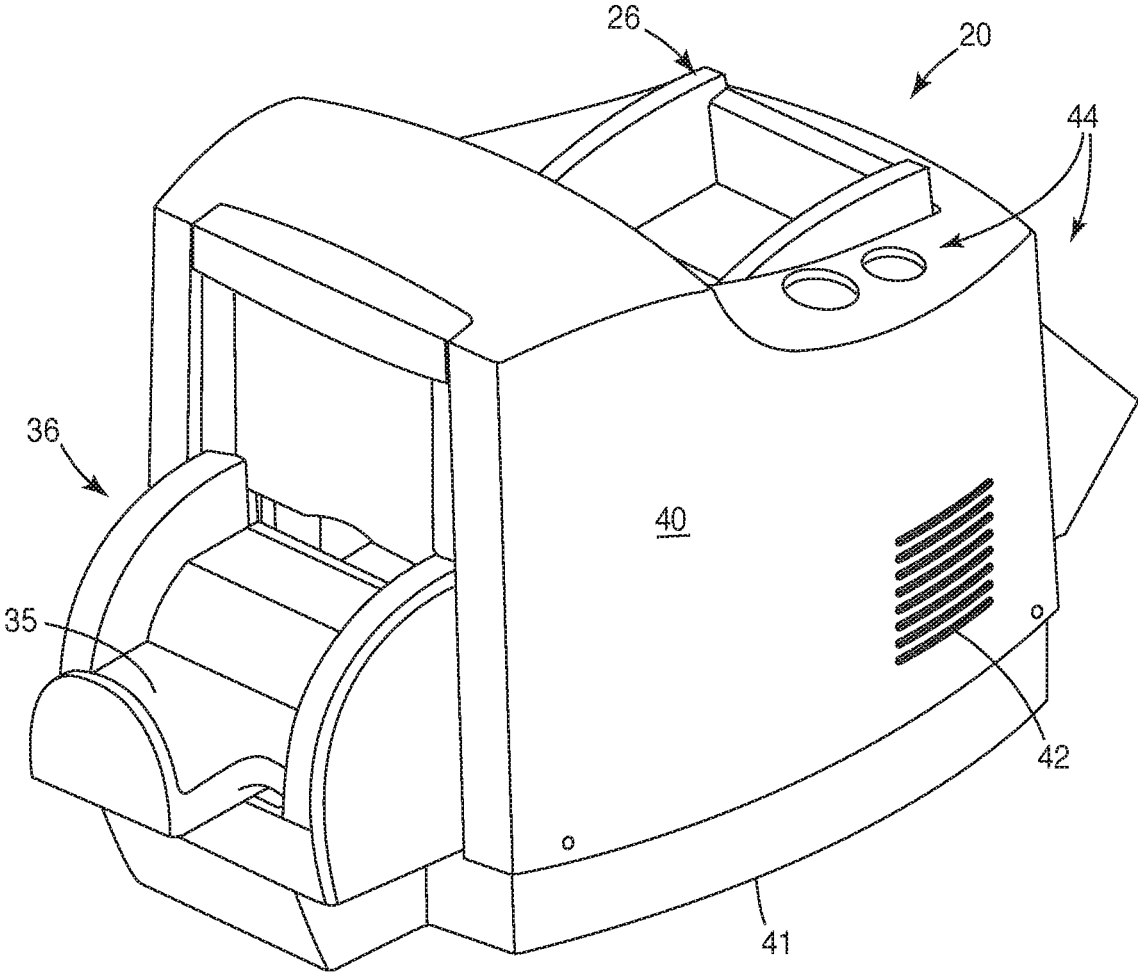


Fig. 1
(Prior Art)



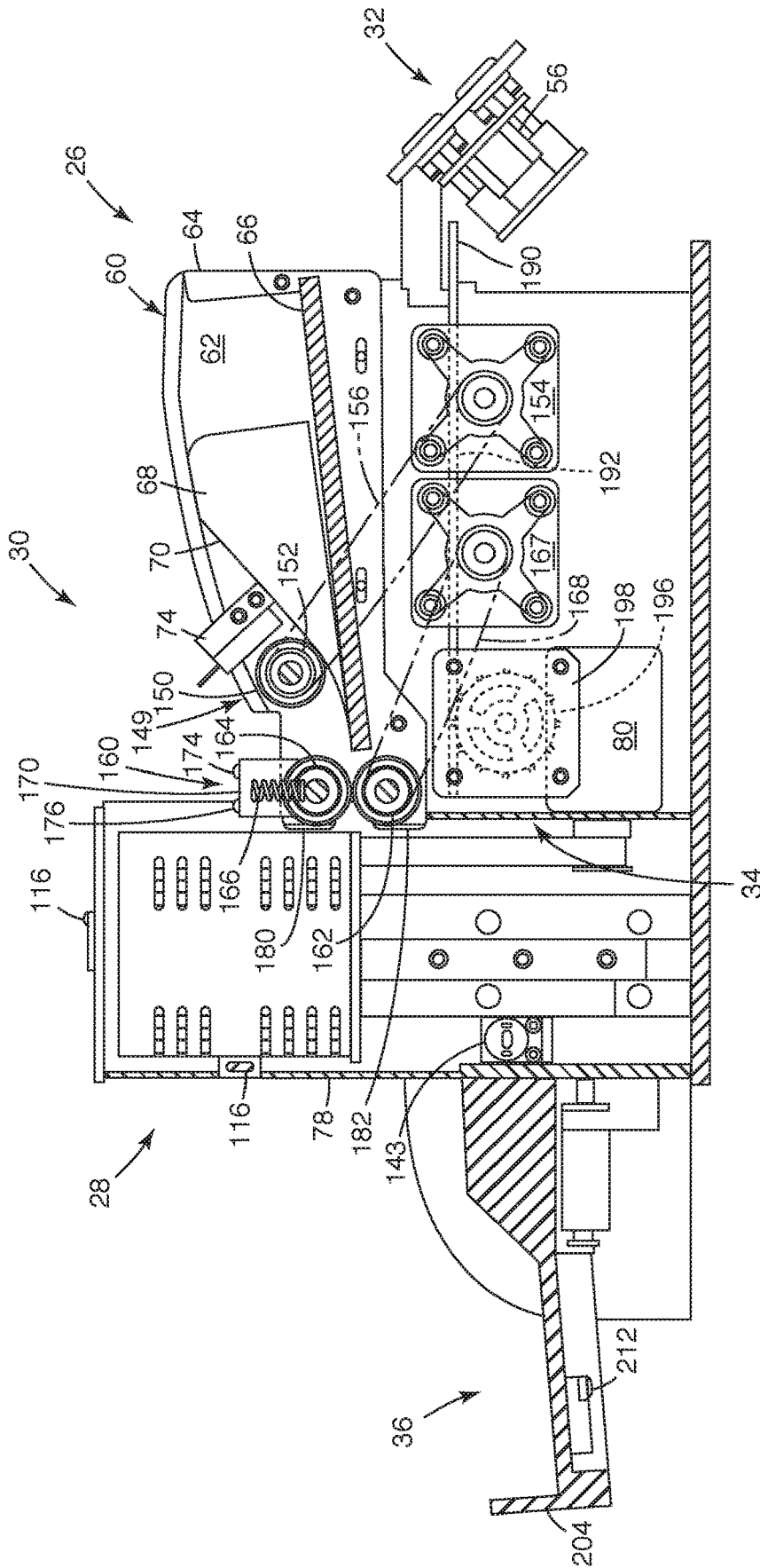


Fig. 2
(Prior Art)

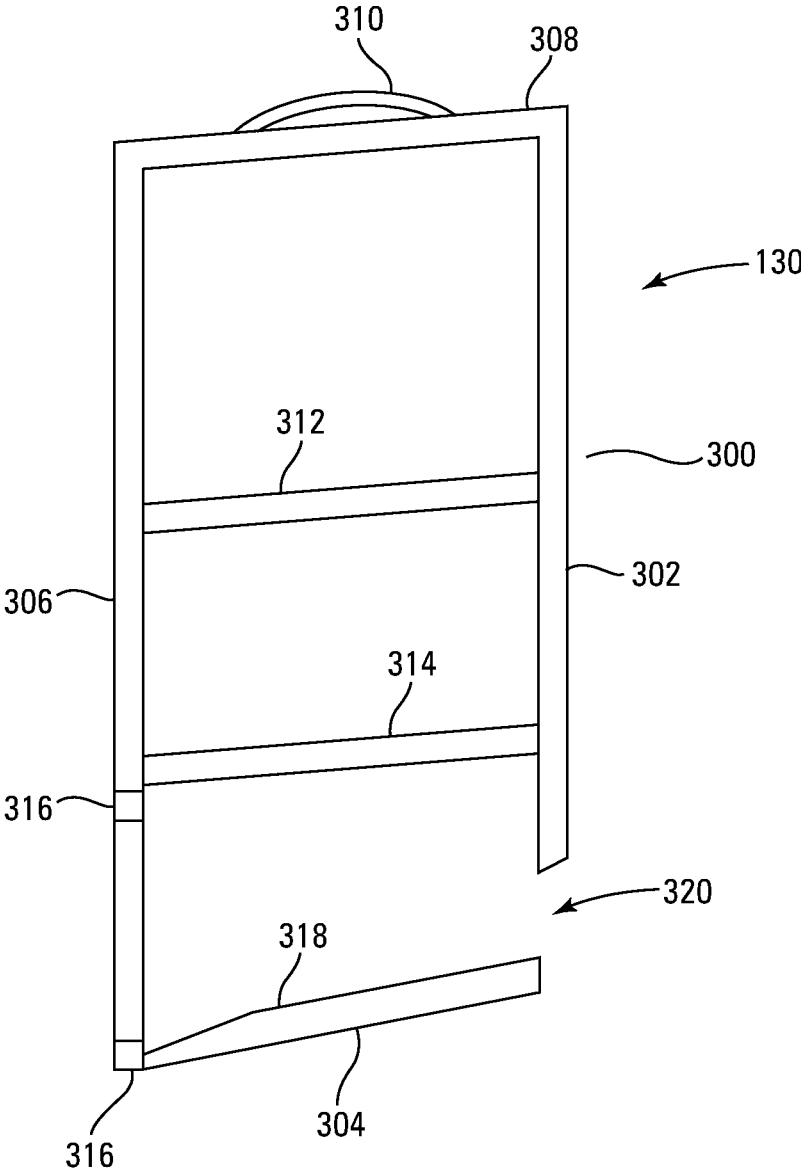


Fig. 3

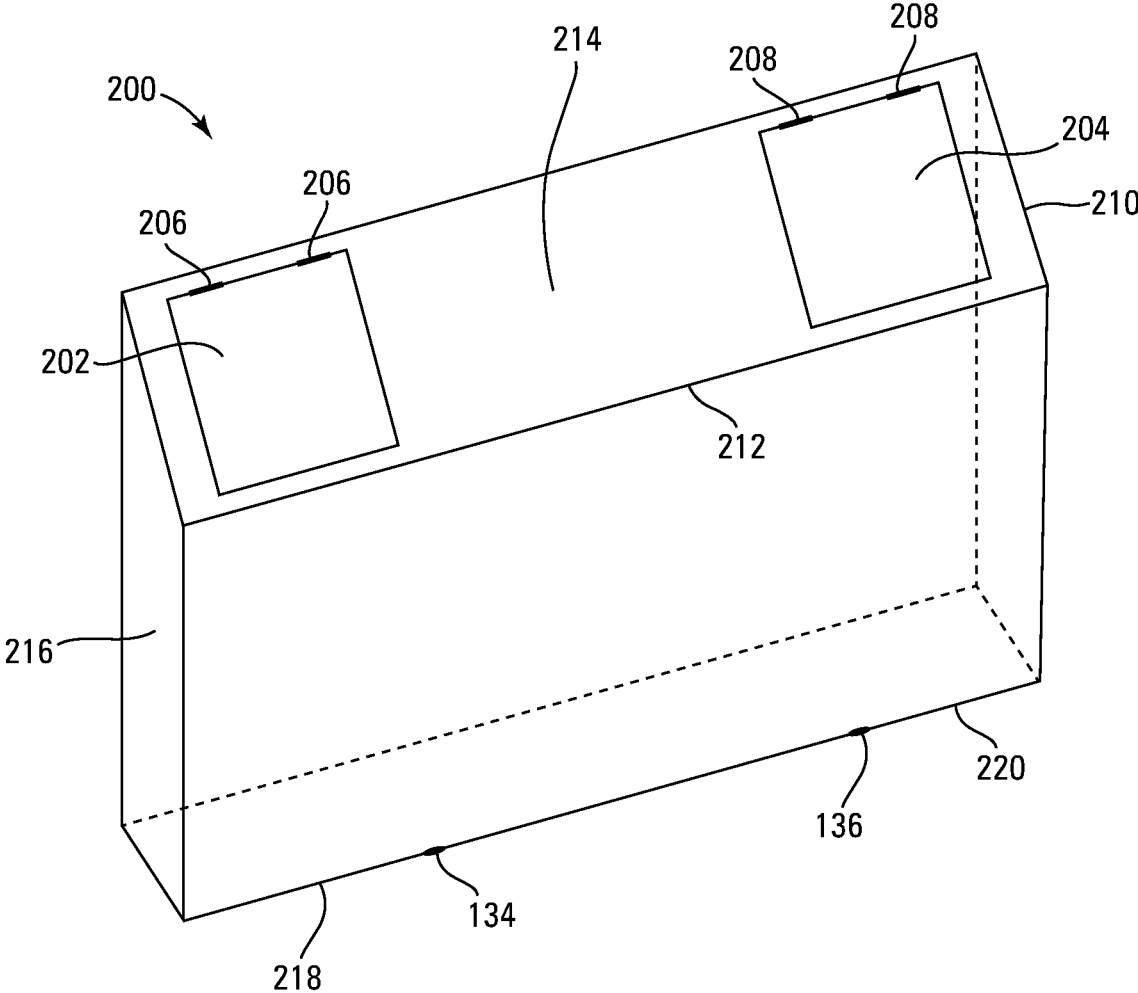
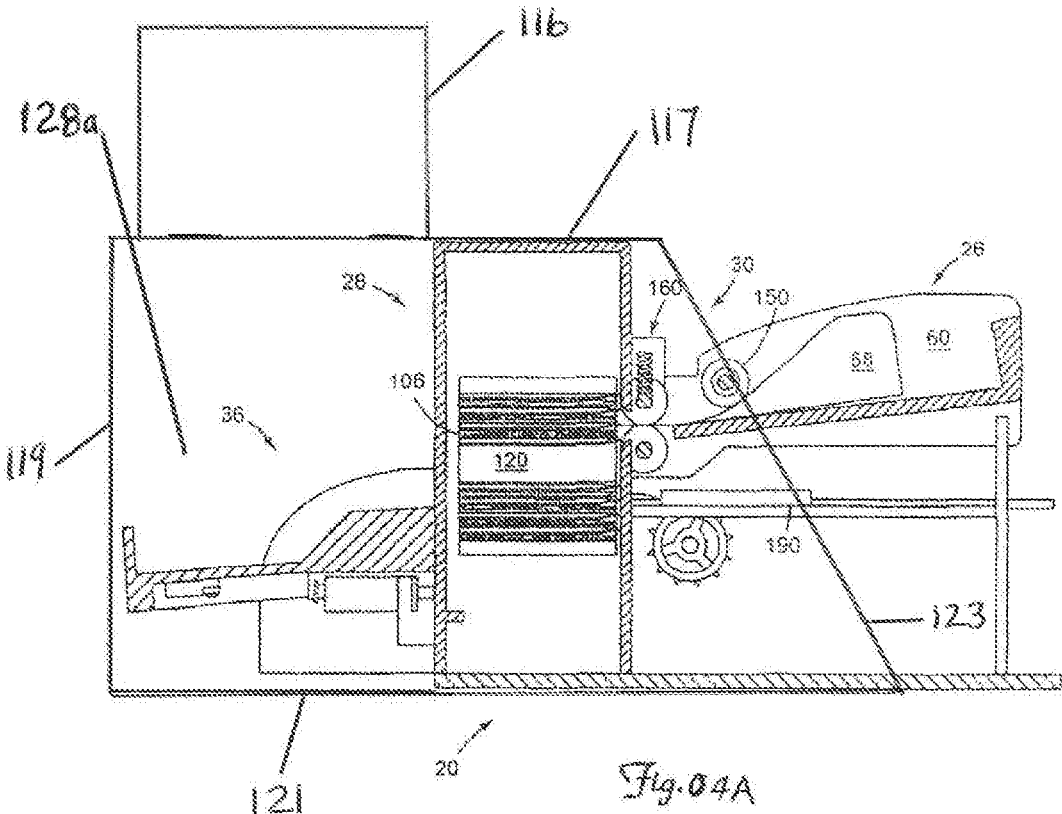
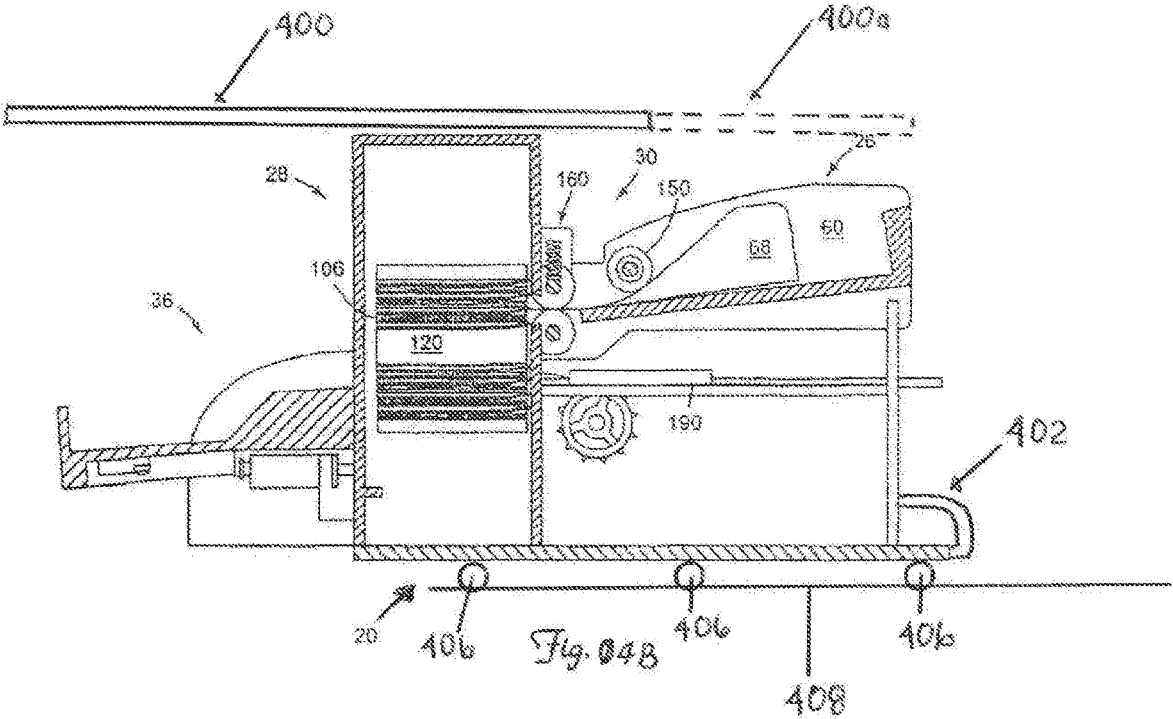


Fig. 4





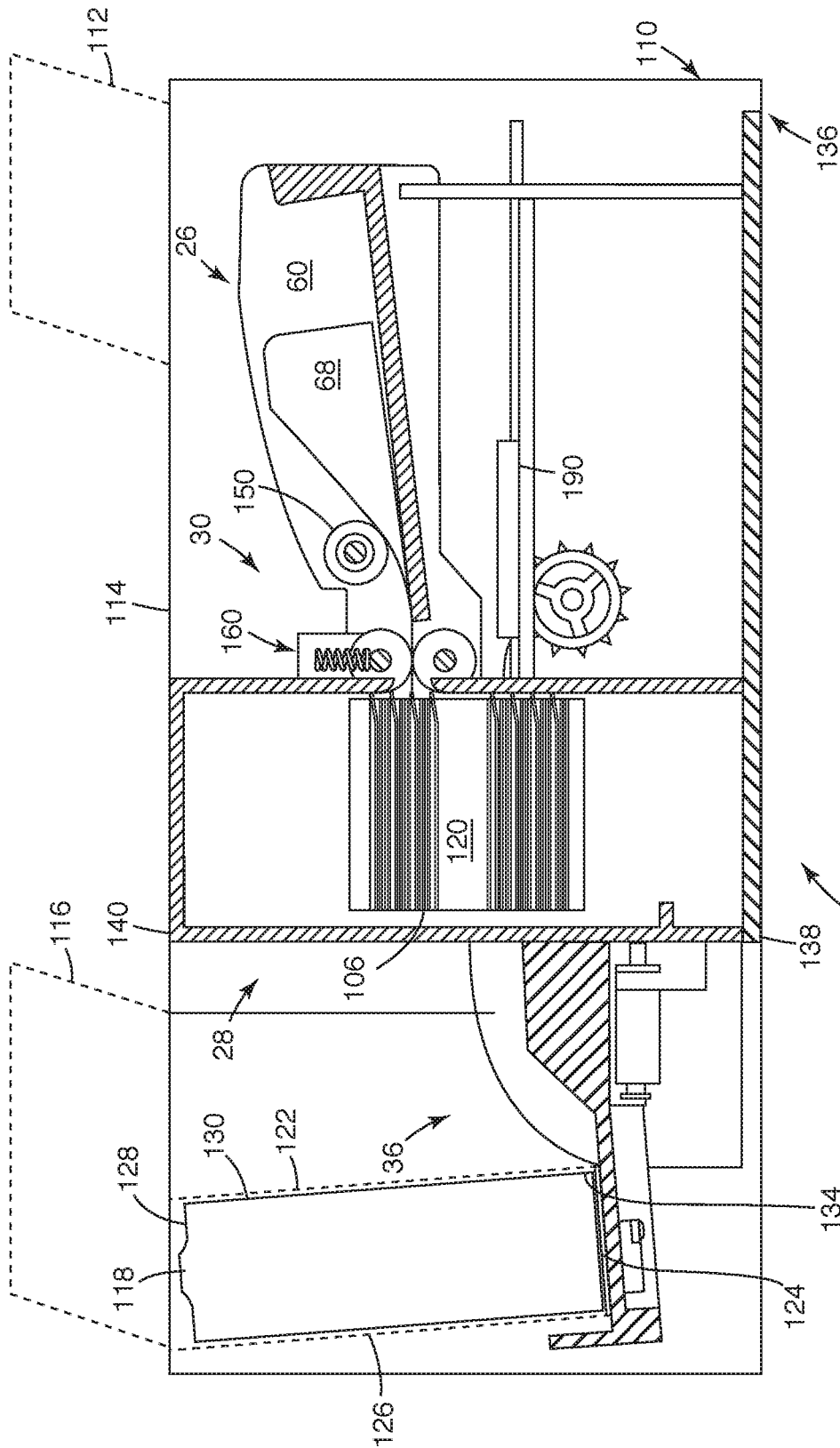


Fig. 5

TABLE-FLUSH SHUFFLING SYSTEM

RELATED APPLICATIONS DATA

[0001] This application claims priority under 35 USC 120 as a continuation-in-part of U.S. patent application Ser. No. 16/208,996, filed 4 Dec. 2018 and titled TABLE-FLUSH SHUFFLING SYSTEM.

BACKGROUND OF THE INVENTION

Field of the Invention

Technical Field

[0002] The present invention relates to devices for handling cards, including cards known as “playing cards.” In particular, the invention relates to an electromechanical card handling machine for organizing, delivering or arranging playing cards into a plurality of hands, wherein each hand is formed as a selected number of randomly arranged cards and different numbers of cards may be provided to different hands on a random basis.

Background

[0003] Wagering games based on the outcome of randomly generated or selected symbols are well known. Such games are widely played in gaming establishments such as casinos and the wagering games include card games wherein the symbols comprise familiar, common playing cards. Card games such as twenty-one or blackjack, poker and variations of poker and the like are excellent card games for use in casinos. Desirable attributes of casino card games are that the games are exciting, they can be learned and understood easily by players, and they move or are played rapidly to a wager-resolving outcome.

[0004] From the perspective of players, the time the dealer must spend in shuffling diminishes the excitement of the game. From the perspective of casinos, shuffling time reduces the number of hands played and reduces the number of wagers placed and resolved in a given amount of time, thereby reducing revenue. Casinos would like to increase the amount of revenue generated by a game without changing games, particularly a popular game, without making obvious changes in the play of the game that affect the hold of the casino, and without increasing the minimum size of wagers. One approach to speeding play is directed specifically to the fact that playing time is decreased by shuffling and dealing events. This approach has led to the development of electromechanical or mechanical card shuffling devices.

[0005] Such devices increase the speed of shuffling and dealing, thereby increasing playing time. Such devices also add to the excitement of a game by reducing the time the dealer or house has to spend in preparing to play the game.

[0006] U.S. Pat. No. 4,586,712 (Lorber et al.) discloses an automatic shuffling apparatus designed to intermix multiple decks of cards under the programmed control of a computer. The Lorber et al. apparatus is a carousel-type shuffler having a container, a storage device for storing shuffled playing cards, a removing device and an inserting device for intermixing the playing cards in the container, a dealing shoe and supplying means for supplying the shuffled playing cards from the storage device to the dealing shoe.

[0007] U.S. Pat. No. 5,000,453 (Stevens et al.) discloses an apparatus for automatically shuffling cards. The Stevens

et al. machine includes three contiguous magazines with an elevatable platform in the center magazine only. Unshuffled cards are placed in the center magazine and the spitting rollers at the top of the magazine spit the cards randomly to the left and right magazines in a simultaneous cutting and shuffling step. The cards are moved back into the center magazine by direct lateral movement of each shuffled stack, placing one stack on top of the other to stack all cards in a shuffled stack in the center magazine. The order of the cards in each stack does not change in moving from the right and left magazines into the center magazine.

[0008] U.S. Pat. No. 3,897,954 (Erickson et al.) discloses the concept of delivering cards one at a time into one of a number of vertically stacked card shuffling compartments. The Erickson patent also discloses using a logic circuit to determine the sequence for determining the delivery location of a card, and that a card shuffler can be used to deal stacks of shuffled cards to a player. U.S. Pat. No. 5,240,140 (Huen) discloses a card dispenser that dispenses or deals cards in four discrete directions onto a playing surface and has a moveable cover, and U.S. Pat. No. 793,489 (Williams), U.S. Pat. No. 2,001,918 (Nevius), U.S. Pat. No. 2,043,343 (Warner) and U.S. Pat. No. 3,312,473 (Friedman et al.) disclose various card holders, some of which include recesses (e.g., Friedman et al.) to facilitate removal of cards. U.S. Pat. No. 2,950,005 (MacDonald) and U.S. Pat. No. 3,690,670 (Cassady et al.) disclose card sorting devices which require specially marked cards, clearly undesirable for gaming and casino play.

[0009] U.S. Pat. No. 4,770,421 (Hoffman) discloses a card shuffling device including a card loading station with a conveyor belt. The belt moves the lowermost card in a stack onto a distribution elevator whereby a stack of cards is accumulated on the distribution elevator. Adjacent to the elevator is a vertical stack of mixing pockets.

[0010] A microprocessor preprogrammed with a finite number of distribution schedules sends a sequence of signals to the elevator corresponding to heights called out in the schedule. Each distribution schedule comprises a preselected distribution sequence, which is fixed as opposed to random. Single cards are moved into the respective pocket at that height. The distribution schedule is either randomly selected or schedules are executed in sequence. When the microprocessor completes the execution of a single distribution cycle, the cards are removed a stack at a time and loaded into a second elevator. The second elevator delivers cards to an output reservoir. Thus, the Hoffman patent requires a two-step shuffle, i.e., a program is required to select the order in which stacks are loaded and moved onto the second elevator and delivers a shuffled deck or decks. The Hoffman patent does not disclose randomly selecting a location within the vertical stack for delivering each card. Nor does the patent disclose a single stage process, which randomly delivers hands of shuffled cards with a degree of randomness satisfactory to casinos and players. Further, there is no disclosure in the Hoffman patent about how to deliver a preselected number of cards to a preselected number of hands ready for use by players or participants in a game. Another card handling apparatus with an elevator is disclosed in U.S. Pat. No. 5,683,085 (Johnson et al.). U.S. Pat. No. 4,750,743 (Nicoletti) discloses a playing card dispenser including an inclined surface and a card pusher for urging cards down the inclined surface.

[0011] Other known card shuffling devices are disclosed in U.S. Pat. No. 2,778,644 (Stephenson), U.S. Pat. No. 4,497,488 (Plevyak et al.), U.S. Pat. Nos. 4,807,884 and 5,275,411 (both Breeding) and U.S. Pat. No. 5,695,189 (Breeding et al.). The Breeding patents disclose machines for automatically shuffling a single deck of cards including a deck-receiving zone, a carriage section for separating a deck into two deck portions, a sloped mechanism positioned between adjacent corners of the deck portions, and an apparatus for snapping the cards over the sloped mechanism to interleave the cards.

[0012] The Breeding single deck shufflers used in connection with LET IT RIDE® Stud Poker are programmed to first shuffle a deck of cards, and then sequentially deliver hands of a preselected number for each player. LET IT RIDE® stud poker is the subject of U.S. Pat. Nos. 5,288,081 and 5,437,462 (Breeding), which are herein incorporated by reference. The Breeding single deck shuffler delivers three cards from the shuffled deck in sequence to a receiving rack. The dealer removes the first hand from the rack. Then, the next hand is automatically delivered. The dealer inputs the number of players, and the shuffler deals out that many hands plus a dealer hand. The Breeding single deck shufflers are capable of shuffling a single deck and delivering seven player hands plus a dealer hand in approximately 60 seconds. The Breeding shuffler is a complex electromechanical device, which requires tuning and adjustment during installation. The shufflers also require periodic adjustment. The Breeding et al. device, as exemplified in U.S. Pat. Nos. 6,068,258; 5,695,189; and 5,303,921, is directed to shuffling machines for shuffling multiple decks of cards with three magazines wherein unshuffled cards are cut then shuffled.

[0013] U.S. Pat. No. 9,126,103 (Krenn) discloses one format of a carousel shuffler where cards are inserted at one side of a carousel, then dispensed at the opposite end of the carousel, usually in an upside-down orientation. The dispensing side is significantly lower than the insertion side of the carousel.

[0014] U.S. Pat. No. 6,659,460 and U.S. Patent Application Publication 2003/007143A1 disclose a carousel-type card shuffler that forms subgroups of cards in a plurality of compartments. Hands are formed in one compartment or in two compartments. The shuffler can be operated as a continuous shuffler for supplying cards to games such as baccarat and twenty-one, or as a hand-forming shuffler for delivering randomized hands of cards to specialty games such as LET IT RIDE® stud poker, pai gow poker and the like.

[0015] U.S. Pat. Nos. 6,651,981 and 6,651,982 disclose a card randomizing shuffler that delivers cards to a randomizing chamber. The cards are supported by an elevator and are lifted to a randomly determined height. Stationary gripping arms grasp a portion of the stack, and then the elevator lowers, creating a gap to insert the next card from a feed tray. This structure delivers batches of cards, although it could be programmed to deliver hands.

[0016] Numerous patents show shuffling devices, especially so-called “grip, lift and insert” systems used in a system that can be flush mounted (the top surface relatively flush with a game table surface, as disclosed in U.S. Pat. No. 10,022,617 (Stasson); U.S. Pat. No. 7,677,565 (Grauzer); U.S. Pat. No. 7,753,373 (Grauzer); U.S. Pat. No. 8,419,521 (Grauzer), U.S. Pat. No. 8,960,674 (Stasson); U.S. Pat. No.

9,849,368 (Stasson); U.S. Pat. No. 9,901,810 (Rynda); These are examples of many state of the art shufflers.

[0017] All patent references listed herein are incorporated herein by reference in their entireties, including their specifications and Figures.

[0018] There are other devices in the marketplace that are not evidenced by any substantive literature. For example, there is a series of commercial shufflers is manufacture by APEX, Inc and marketed as the Shuffle King II, the SK2, the Shuffle King 6, and the Shuffle King 8, variously. That shuffler has a playing card insertion plate that opposes a semicircular array of compartments. Playing cards from the top or bottom of the playing cards (which may be non-random or already random) on the insertion plate and inserted into compartments (randomly or in order) to create a distribution (random or not) in the compartments. After all cards have been inserted into compartments, the individual compartments are emptied back onto the playing card insertion plate (now effectively acting as a playing card collection plate). If the cards were not random in the compartments, the compartments must be emptied randomly onto the collection plate. This shuffler can be used as a table-top flush-mounted shuffler as the insertion dual action (insertion and collection) plate is relatively elevated within the shuffling system.

[0019] Although the devices disclosed in the preceding patents provide improvements in card shuffling devices, only two or three systems (such as the APEX system and the grip, lift and insert system are able to provide commercial flush-mounted systems. The other systems, such as the elevator operating stacked array and carousel shufflers receiving playing cards on one side of the carousel and delivering them on the opposite side of the carousel have not been used as flush-mounted or table-top surface mounted shufflers because of dimension limitations (particularly in the vertical dimension) on sizes of systems. Additionally, there are many older, high quality shufflers (such as the ace Shufflers using the elevator driven stacked array of compartments and the One-2-Six® shufflers represented by the above Krenn Patent) that are being stored in casinos after purchase, or even in second-hand stores because they have a limited function in casinos, basically for is hand-delivery or batch delivery for single deck varietal playing card games (such as Three-Card Poker® games, Four-Card Poker games, Caribbean Stud® poker, Ultimate Texas Hold’Em Poker and other games). Player-versus-player poker games, especially in card rooms, prefer the relatively flush-mounted shufflers having covers that are relatively (plus-or-minus 0.5 inches with respect to the top surface of the game table) mounted with panels giving access to deliver and remove playing cards relatively flush with the table-top. It would be commercially desirable if the older technology and highly robust (with over fifteen years of evidence of longevity in use) devices cannot meet commercial requirements for use in poker-type rooms, providing flush-mounted systems.

SUMMARY OF THE INVENTION

[0020] A playing card randomization system including:

[0021] a) a playing card randomization system having a shuffling zone;

[0022] b) on one side of the shuffling zone is a playing card insertion area comprising a playing card support surface at a first elevation with respect to a highest level within the randomization system;

- [0023] c) associated with the playing card support surface is a playing card mover that moves individual playing cards from the playing card support surface one-at-a-time into a first side of the shuffling zone;
- [0024] d) a randomized playing card collection surface at a second elevation with respect to the randomization system;
- [0025] e) the collection surface at the second elevation being at least 5 centimeters lower than the playing card support surface with respect to the highest level within the randomization system;
- [0026] f) an elevator supporting the playing card support surface;
- [0027] g) the elevator being free of any mechanical drive below the playing card collection surface capable of moving the playing card collection surface upward to elevate a top playing card in a single fifty-two deck of physical playing cards on the playing card collection surface to within 5 cm of the highest level within the randomization system; and
- [0028] h) the elevator being sufficiently moveable by manual lifting of the elevator or a side-engaged drive associated with at least one support arm of the elevator so as to elevate a top playing card in a single fifty-two deck of physical playing cards on the playing card collection surface to within 5 cm of the highest level within the randomization system.

BRIEF DESCRIPTION OF THE DRAWINGS

- [0029] FIG. 1 (PRIOR ART) is a front perspective view depicting the apparatus of the present invention as it might be disposed ready for use in a casino on a gaming table.
- [0030] FIG. 2 (PRIOR ART) is a side elevation view of a commercial shuffler (the ACE® shuffler) that can be used in one embodiment of a practice of the present invention with the shroud and other portions of the apparatus removed to show internal components, and a gaming content display 32.
- [0031] FIG. 3 is a side view of an elevator that may be used in the practice of the present invention.
- [0032] FIG. 4 is a perspective view of a casing useful in converting some commercial prior art shufflers (as in FIG. 1) to a flush-mountable table-embedded shuffler.
- [0033] FIG. 04A is a side view of a casing further useful in converting shufflers or using duplicated shufflers to a flush-mounted table-embedded shuffler.
- [0034] FIG. 04B is a side view of a casing further useful in converting shufflers or using duplicated shufflers to a flush-mounted table-embedded shuffler in which the shuffler is supported on a sliding base or glides that slide over a base to allow access to a front end of the shuffler.
- [0035] FIG. 5 is a simplified side elevational view, largely representational, of an encased first card handler (without a gaming content display as in FIG. 2) encased in a converting shell according to practices of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

- [0036] A playing card randomization system including:
- [0037] a) a playing card randomization system having a shuffling zone;
- [0038] b) on one side of the shuffling zone is a playing card insertion area comprising a playing card support

surface at a first elevation with respect to a highest level within the randomization system;

- [0039] c) associated with the playing card support surface is a playing card mover that moves individual playing cards from the playing card support surface one-at-a-time into a first side of the shuffling zone;
- [0040] d) a randomized playing card collection surface at a second elevation with respect to the randomization system;
- [0041] e) the collection surface at the second elevation being at least 5 centimeters lower than the playing card support surface with respect to the highest level within the randomization system;
- [0042] f) an elevator supporting the playing card support surface;
- [0043] g) the elevator being free of any mechanical drive below the playing card collection surface capable of moving the playing card collection surface upward to elevate a top playing card in a single fifty-two deck of physical playing cards on the playing card collection surface to within 5 cm of the highest level within the randomization system; and
- [0044] h) the elevator being sufficiently moveable by manual lifting of the elevator or a side-engaged drive associated with at least one support arm of the elevator so as to elevate a top playing card in a single fifty-two deck of physical playing cards on the playing card collection surface to within 5 cm of the highest level within the randomization system.

[0045] In simple terms, a flush-mounted device (with respect to a table top) is provided using old shuffling technology that has not been previously enabled for use in flush-mounted systems. Playing cards are entered into the device one side of an electromechanical shuffling system (preferably a stacked array or carousel array of compartments that discharges random cards) and discharged on an opposed side of the electromechanical shuffling system. The nature of these preferred electromechanical shuffling systems is that the support on the playing card entry side is significantly higher (e.g., at least 5 cm, preferably at least 10 centimeters) than the playing card collection surface on the discharge side of the electromechanical shuffling system. An elevator is on the discharge side of the electromechanical shuffling system, which elevator lifts cards on the collection (discharge) surface upward for manual removal by a dealer. The elevator does not have a long piston drive underneath the collection surface. As there can be a structural surface below the collection surface (such as the collection surface or dealer tray in an old shuffler reconfigured according to the present invention), there may even be no mechanical drive for the elevator, but only a handle on a top portion or surface of the elevator so that, effectively, only manual force is used to raise the elevator to access randomized playing cards on the collection surface of the elevator.

[0046] FIG. 3 shows a manually lifted elevator 130. The elevator 130 has a face that is towards a randomizing zone (not shown) with a face 302 that passes from the top 308 of the elevator 130 to form a gap 320 above the bottom 304 of the elevator 130. A top surface 318 of the bottom 304 is sloped away from the gap 320 to assist cards moving forward towards a far face 316 of the elevator. An option is to have a hinge 316 on the bottom 304 to enable cards to be removed from the elevator easily if the entire elevator is removed from the shuffling system, as opposed to elevating

the elevator 130 sufficiently to remove randomized cards from an open side or the gap 320 in the elevator 130. Alternatively, the face 302 may pivot. Structural supports 312 and 314 may be attached to or merely abut face 302. An optional, but desirable second or alternative hinge 316 is farther up elevator back face 306 to enable a point of flexing making cards on the bottom 304 more accessible when the elevator 130 is lifted upwards from within the card shuffling device (see FIG. 5).

[0047] FIG. 4 shows a frame 200 that can overlay a shuffling device such as those in FIGS. 1 and 2. The housing 200 assists in converting a table-seated shuffler (such as the ACE® shuffler) into a flush-mounted shuffler, in combination with an elevator as in FIG. 3. The frame 200 is shown with a first panel 202 with two hinges 206, and a second panel 204 also with two hinges 208. As an example, the hinged panel 204 may overlay a card insertion plate (not shown) in a shuffler, and panel 202 may overlay the elevator (not shown) over the card collection surface (not shown). The forward face 216 will (on the inside) abut the collection plate (not shown) of the shuffler, just as the front bottom 218 and the rear bottom 220 support the shuffler (not shown). There may be multiple connectors 134 and 136, for example, that will connect the frame 200 to the shuffler (not shown). The is connectors 134 136 may be snaps, screws, welds (less preferred), glued attachments, bolts, pins and holes, and any other known connector system, preferably reversible connectors, so that the frame 200 can be separated from the shuffler to enable repairs.

[0048] FIG. 5 is a simplified side elevational view, largely representational, of an encased first card handler 20 (without a gaming content display as in FIG. 2) encased in a converting shell 110 according to practices of the present invention. The shell 110 may have two flip open panels 112 and 116 (or they may be connected to be a single panel (not shown)). A top 114 of the shell 110 conforms to a top surface 140 of the compartment array 106, with a gap 120 shown in the grip, lift and insert system. Elements in FIG. 5 with numbering the same as in FIGS. 2 and 4 represent the same elements. The elevator 130 is slideably supported within walls 122 and 126. The elevator 130 is shown at a slight tilt so that the base of the elevator 124 is properly seated with respect to the tray 36 (see FIG. 2). The elevator 130 may be vertical by having the bottom 124 remain flush, but with the sides of the elevator 130 adjacent the walls more vertical and the walls 122 and 126 also vertical. The top 128 of the elevator 130 is shown with a handle 118. The handle is shown elevated from the top 128 of the elevator 130, but optionally may be recessed into the top 128. There optionally may be a physical stop system (ledge and pin, pin and hole slide, etc.) to prevent the elevator from being lifted completely through the cover 116. Such a physical stop may also facilitate flexing, bending of the elevator (see FIG. 3, element 316) to facilitate card removal from the elevator 130. There may be gear drives, friction wheels, chain gears and the like (not shown) adjacent the sides of the elevator 130 to raise the elevator if that is preferred to a manual lift.

[0049] All components of the electrical system and wiring harness of the present invention is may be conventional, commercially available components unless otherwise indicated, including electrical components and circuitry, wires, fuses, soldered connections, chips, boards, microprocessors, computers, and control system components. The software may be developed simply by hired programming without

undue experimentation, the software merely directing physical performance of components without unique software functionality (that is, the components are physically moved in a normal manner, but moved to effect different card count results), although unique applications of software are described. For example, random number generation or pseudo-random number generation by software is known in the art, but it has not been heretofore used to randomly determine a) when a number of cards in a hand is to be varied, b) by how many cards (even within fixed parameters) a number of cards in a hand is to be varied from a standard, c) whether a player's hand or a dealer's hand is to be varied, or d) to randomly select between the dealer and the player when a number of cards in a hand is to be varied.

[0050] The presently described technology includes a method that may be performed on card shuffling, card randomization or hand forming apparatus. One apparatus of the technology described herein provides hands of playing cards in a casino table card game and may comprise a container for a random group of playing cards; a card moving system for moving playing cards from the random group of playing cards, one playing card at a time to a delivery tray to form a hand of playing cards; and a processor randomly selecting how many playing cards will form a hand in the delivery tray.

[0051] At least some of the apparatus within the technology described herein may alternatively or differently be described as an apparatus for providing hands of cards in a casino table card game comprising a container for receiving a first group of cards; a system for forming random subsets of playing cards within the apparatus; a card moving system for moving the random subsets of cards to a delivery tray to form hands of cards; and a processor controlling the card moving system.

[0052] The processor may contain a program (in hardware or software) that randomly selects at least one variation from the group consisting of: a) a number of cards in a hand of cards formed in the delivery tray; b) a hand in which a random number of cards will be provided; c) when player hands and a dealer hand are provided, whether a player hand or dealer hand will receive a random number of cards; and d) a frequency at which random numbers of cards will be provided to at least one hand. The processor may randomly select a number of cards from within a defined range that will be provided to at least one hand in the casino table card game. The processor may randomly select a hand that is to contain a random number of cards. The processor may randomly select a hand that is to contain a random number of cards from within a predetermined range of numbers of cards. The apparatus may operate so that only player hands, only dealer's hands, or both players' and dealer's hands, and even community cards may be selected to contain a random number of cards. The processor may be programmed or hard-wired in a wide variety of ways to accomplish delivery of card hands or cards with a randomly determined number of cards in the hand.

[0053] Apparatus within the generic concepts described herein may also be described as being for randomizing playing cards and forming hands of playing cards comprising: a receiving area for a first set of playing cards; a randomization area wherein the first set of cards is randomized; a processor for controlling at least the randomization area; and a delivery tray where individual hands of playing cards are delivered or formed as a hand within the delivery

tray; wherein the processor is randomly selects a number of cards to be delivered or formed within the delivery tray. The apparatus may deliver only player hands, only dealer hands, only community cards or combinations of these hands and groups of cards formed in or delivered to the delivery tray.

[0054] A method of providing hands of playing cards for use in a casino table card game may also be practiced on the apparatus. The method may comprise: randomizing a first group of cards within an apparatus; and providing hands of a number of randomized cards for delivery to locations on a casino game table; wherein the number of randomized cards is randomly determined. The method may include determining the number of randomized cards in each hand from within a predetermined range of numbers of cards. The method may include an underlying game play procedure in the casino table card game that is played with players using a specific number of cards to form poker-type hands, and the random number of cards to be determined is selected from the group consisting of the specific number of cards, fewer than the specific number of cards, and more than the specific number of cards. The method may also include an underlying game play procedure in the casino table card game that is played with players using a specific number of cards to form poker-type hands, and the random number of cards to be determined is selected from the group consisting of a) the specific number of cards and b) more than the specific number of cards. The method may be practiced wherein a randomized group of cards is formed within the apparatus and cards are delivered one at a time to the delivery tray to form individual hands, or wherein hands of random cards are formed within the apparatus and the hands of random cards are pushed onto the delivery tray. The groups of cards pushed into the delivery tray (one at a time or in groups) may be complete hands of cards or partial hands of cards.

[0055] Generally, unless specifically otherwise disclosed or taught, the materials for making the various components of the present invention are selected from appropriate materials such as metal, metallic alloys, ceramics, plastics, fiberglass, composites and the like.

[0056] In the following description, the Appendices and the claims, any references to the terms “right” and “left,” “top” and “bottom,” “upper” and “lower,” and “horizontal” and “vertical” are to be read and understood with their conventional meanings and with reference to viewing the apparatus from whatever convenient perspective is available to the viewer, but generally from the front as shown in the figures.

[0057] A method is provided wherein a first group of cards (e.g., usually at least one or exactly one deck of playing cards) is provided (as in a card group input area) for randomization and provision as individual hands or individual partial or “initial” hands of playing cards in a casino table card game, preferably a live casino table card game. The first group of cards is randomized in either forming a randomized group comprising all of the cards in the first group of cards or by forming randomized subgroups of cards, with each subgroup having fewer numbers of cards than the first group of cards. The total number of cards in the subgroups of cards may be equal to the number of cards in the first group, or less than the number of cards in the first group of cards (e.g., with remnant cards, or excess cards not to be used in a game or round of play temporarily retained in a card group input area or moved with or without randomization to a discard or excess card compartment). A

program is associated with a processor that controls the card randomization device or system that can be programmed to provide varying numbers of cards in hands to be delivered to players, to dealers, to community cards (e.g., to a flop) or to players and/or dealers. For example, in certain games it may be a feature that where a standard number of cards are usually dealt to a player or dealer (e.g., three cards, four cards, five cards, six cards or seven cards), the program may direct the shuffler to form a single hand with one to seven cards fewer than or greater than the standard number. This would provide a new feature in games, a random number of cards in hands, whether player hands or dealer hands or both. For example, if a game within the genre of five-card stud poker were being played, the random provision of six or seven cards (or any number greater than five cards) to a player would offer an exciting and unexpected, yet anticipated advantage. Similarly, the provision of only three or four cards (or any number less than five cards) to a player would be a temporary disappointment, but part of the anticipation in the play of casino table games. This disappointment could be offset by special bonuses for ranked hands in the hand with fewer cards.

[0058] For example, in the five-card stud poker game, three-of-a-kind with only three cards might automatically provide a bonus of at least 5:1, 10:1, 20:1 or more (as is more typical in THREE CARD POKER® games), while a bonus award for three-of-a-kind in a five-card poker game is ordinarily only about 3:1.

[0059] When the dealer is randomly provided with a number of cards different from the standard number, more cards for the dealer’s hand become disadvantageous to the player, and fewer cards can become more advantageous to a player. The rules of the game may or may not allow for five-card flushes and four-card straights to tie five-card hands of equal rank according to other rules of poker (e.g., the highest card in a flush or straight provides the final basis of rank).

[0060] The presently described technology provides an electromechanical card handling apparatus and method for creating or generating a plurality of hands of cards from a group of unshuffled cards wherein each hand contains a predetermined or randomly determined number of randomly selected or arranged cards. The apparatus and, thus, the card handling method or process, is controlled by a programmable microprocessor and may be monitored by a plurality of sensors and limit switches. While the card handling apparatus and method of the present invention is well suited for use in the gaming environment, particularly in casinos, the apparatus and method may find use in homes, card clubs at charitable gaming events and at parties.

[0061] In one embodiment, an apparatus provides for moving playing cards from a first group of unshuffled cards into shuffled hands of cards, wherein at least one and usually all of the hands contain a random arrangement or random selection of a preselected number of cards. A random number of cards is provided in at least one hand at some time during one or more rounds of play of a game, and the number of cards, frequency of events, and location of events can be predetermined or randomly determined by operation of software or hardware in the shuffler or associated with the shuffler. One exemplary apparatus comprises a card receiver for receiving the first group of cards, a shuffling mechanism that randomizes the first group of cards into a single batch of randomized cards or into smaller multiple groups of

randomized cards (e.g., at least some smaller groups comprise two or more cards, but less than all the cards in the first group of cards), a hand delivery system that delivers groups of at least two cards as hands (although delivery to the tray may be one card at a time) or partial hands to a delivery tray, and a processor that randomly determines that during play of rounds of a game (not necessarily every round, although that is possible), at least one hand or partial hand has a number of cards that differs from a number of cards provided to other hands or partial hands in that same round or in another round of a single game.

[0062] Another available feature within the presently described technology is that it provides a programmable card handling machine with a display and appropriate inputs for adjusting the machine to any of a number of games wherein the inputs include a number of cards per hand selector, a card game selector, a number of is hands delivered selector and a trouble-shooting input. Additionally, when there is an elevator used to assist in card movement, there may be an elevator speed adjustment and sensor to accommodate or monitor the position of the elevator position as cards wear or become bowed or warped. These features also provide for interchangeability of the apparatus, meaning the same apparatus can be used for many different games, for many types of cards or decks and in different locations thereby reducing the number of back-up machines or units required at a casino. The display may include a game mode or game selected display, and use a cycle rate and/or hand count monitor and display for determining or monitoring the usage of the machine.

[0063] Another feature of the presently described technology is that it provides an electromechanical playing card handling apparatus for more rapidly generating multiple random hands of playing cards, and for providing the random hands in diverse formats and counts. The preferred device completes a cycle in approximately 30 seconds, which is double the speed of the Breeding single deck shuffler disclosed in U.S. Pat. Nos. 4,807,884 and 5,275,411, which has achieved significant commercial success. Although some of the groups of playing cards (including player and dealer hands and discarded or unused cards) arranged by the apparatus in accordance with the method of the present invention may contain the same number of cards, the cards within any one group or hand are randomized, as by being randomly selected and placed therein or by being selected from a randomized reordered set of playing cards and fed as hands, as cards building a hand one card at a time, or fed to compartments where further randomized sets of cards, including hands, may be formed. Other features of the presently described technology include a reduction of set-up time, increased reliability, lower maintenance and repair costs, and a reduction or elimination of is problems such as card counting, possible dealer manipulation and card tracking. These features increase the integrity of a game and enhance casino security.

[0064] Yet another feature of the card handling apparatus of the presently described technology is that it converts a single deck or multiple decks of unshuffled cards into a plurality of hands ready for use in playing a game, including games where different numbers of cards can be or are required to be provided to different players' hands or a dealer's hand, even where that different number of cards may be provided randomly to players' or the dealer's hands. The hands converted from the initial deck or decks of cards

are substantially completely random, i.e., the cards comprising each hand are randomly selected or provided to be placed into that hand.

[0065] To accomplish this random distribution, a preferred, non-limiting embodiment of the apparatus includes a number of vertically stacked, horizontally disposed card receiving compartments one above another into which cards are inserted, one at a time, until an entire group of cards is distributed. In this preferred embodiment, each card receiving compartment is filled (filled to the assigned number of cards for a hand, and with the residue of cards being fed into one or more discard compartments, for example), regardless of the number of players participating in a particular game. For example, when the card handling apparatus is being used for a seven-player game, seven player compartments, a dealer compartment and at least one compartment for cards not used in forming the random hands to be used in the seven-player game are filled. After the last card from the unshuffled group is delivered to a last hand forming compartment still lacking cards, the hands are ready to be removed from the compartments and put into play, either manually, automatically, or with a combined automatic feed and hand removal. In some is cases, the discard rack or racks have received all unused cards when hands are unloaded, but in other cases, hands unload before all discards are loaded into the discard rack.

[0066] The device can also be readily adapted for games that deal a hand or hands only to the dealer, such as Daniel Jones and David Sklansky's HOLD 'EM CHALLENGE® poker game, described in U.S. Pat. No. 5,382,025.

[0067] The device of the presently described technology may include jammed card detection and recovery features, and may include recovery procedures operated and controlled by the microprocessor.

[0068] Generally, the operation of card handling apparatuses of prior art shufflers has formed a fixed number of hands of cards corresponding to the maximum number of players at a table, plus a dealer hand (if there is a dealer playing in the game), with each hand being of a specific predetermined number of cards, and usually an equal number of cards, plus a discard pile. For example, U.S. Pat. No. 5,275,411 describes a shuffler and associated devices particularly for use in the play of pai gow poker. The device deals hands of a predetermined number (seven) of cards and then ejects all remaining (four cards, and the deck has 52 cards plus a joker) cards. The patent refers to other devices in patent literature as follows. "U.S. Pat. No. 4,513,969 (to Samsel, Jr.) and U.S. Pat. No. 4,515,367 (to Howard) disclose automatic card shufflers. The Samsel, Jr. patent discloses a card shuffler having a housing with two wells for receiving two reserve stacks of cards. A first extractor selects, removes and intermixes the bottommost card from each stack and delivers the intermixed cards to a storage compartment. A second extractor sequentially removes the bottommost card from the storage compartment and delivers it to a typical shoe from which the dealer may take it for presentation to the players. The Howard patent discloses a card mixer for randomly interleaving cards including a carriage supported ejector for ejecting a group of cards (approximately two playing decks in number) which may then be removed manually from the shuffler or dropped automatically into a chute for delivery to a typical dealing shoe. Neither of the Samsel, Jr. or Howard patents discloses a dealing module for dealing hands of a predetermined

number of cards depending on the rules and procedures of the game being played, and neither discloses a display means for displaying game-related information to players.”

[0069] For a typical casino table having seven player stations, some of the devices would preferably have nine compartments (if there are seven players and a dealer) or eight compartments (if there are seven players and no dealer playing in the game), wherein each of seven player compartments contains the same number of cards. Depending upon the nature of the game, the compartments for the dealer hand may have the same or a different number of cards as the seven compartments, and these numbers would be fixed into the program performed by the shuffler, and the discard compartment may contain the same or a different number of cards as the player compartments and/or the dealer compartment, if there is a dealer compartment. Most preferably, the device according to the present technology is programmed to deliver hands until the dealer (whether playing in the game or operating as a house dealer) presses an input button or until the shuffler registers that there are insufficient cards remaining to form a complete hand, or that a predetermined limit of a number of hands has been reached. Any other information or state in the machine indicating that all remaining cards should be removed from the shuffler is also suitably used in the practice of the present technology. The dealer input may tell the microprocessor that the last hand has been delivered (to the players or to the players and dealer), and then the remaining cards in the compartments (excess player compartments and/or discard compartment and/or is excess card compartment) will be unloaded into the output or discard compartment. The discard, excess or unused card hand (i.e., the cards placed in the discard compartment or slot) may contain more cards and, thus, the discard compartment may be larger than the other compartments. In a preferred embodiment, the discard compartment is larger than the other compartments and is located in the middle of the generally vertically arranged stack of compartments to minimize travel distances of the rack.

[0070] Another feature is that the apparatus of the presently described technology may provide for the initial top feeding or top loading of an unshuffled group of cards, thereby facilitating use by the dealer. The hand receiving portion of the machine may also facilitate use by the dealer, by having cards displayed or provided so that a dealer is able to conveniently remove a randomized hand from the upper portion of the machine or from a tray or platform extending forwardly from the machine or to expose the cards to a vertical or nearly vertical access (within 0° to 30° or 0° to 50° of horizontal, for example) by the dealer’s hand.

[0071] An additional feature of the card handling apparatus as presently described is that it facilitates and significantly speeds the play of casino wagering games, particularly those games calling for a certain, fixed number of cards per hand (e.g., CARIBBEAN STUD®, LET IT RIDE®, pai gow poker, TRES CARD™ poker, THREE CARD POKER®, HOLD ’EM CHALLENGE® poker, stud poker games and the like, and new games and bonus events in games, or random bonus or play events where random numbers of cards in excess of or less than the standard number of cards are provided to one or more players or a dealer), making the games more exciting and less tedious for players, and more profitable for casinos. The device of the present invention is believed to deliver random hands at an increased speed compared to other shufflers.

[0072] In use, the apparatus of the present invention is operated to process playing cards from an initial, unshuffled or previously used group of cards into a plurality of hands, and where each hand (and especially each player hand) enables the provision of hands with different numbers of cards, players’ hands with different numbers of delivered cards, and even the random provision of hands with different numbers of cards to players or to dealers, or to players and dealers. The random number may be larger or smaller than the number of cards standardly provided to players and/or dealers.

[0073] For example, in a five card stud game, where exactly five cards are dealt and used by players and the dealer, a random number generator may provide six cards to a player or dealer on a random basis or on a set or random frequency (e.g., every ten hands or on a randomly selected number of hands), and/or may provide four cards to a player and/or a dealer on a random basis or on a set or random frequency. It should be understood that the term “unshuffled” is a relative term. A deck is unshuffled a) when it is being recycled after play and b) after previous shuffling before a previous play of a game, as well as c) when a new deck is inserted into the machine without ever having been previously shuffled. The first step of this process is effected by the dealer placing the initial group of cards into the card receiver of the apparatus. The apparatus is started and, under the control of the integral microprocessor, assigns each card in the initial group to a compartment (randomly selecting a compartment for each card), based on the selected number of hands, and a selected number of cards per hand.

[0074] Each hand is contained in one or several separate compartments of the apparatus, and each is delivered (upon the dealer’s demand or automatically) by the apparatus from that compartment to a hand receiver or platform for the dealer to distribute it to a player. Although in one embodiment a complete hand is formed in a single compartment, more than one compartment can be provided so that a final complete or partial hand is formed (e.g., in a delivery tray) from subgroups of cards formed in two or more compartments. The subgroups are then combined in the delivery tray to form a hand. The number of hands created by the apparatus within each cycle is preferably selected to correspond to the maximum number of hands required to participate in a game (accounting for player hands, dealer hands, or house hands), and the number or quantity of cards per hand is programmable according to the game being played.

[0075] Each time a new group of unshuffled cards, hand shuffled cards, used cards or a new deck(s) of cards is loaded into the card receiver and the apparatus is activated, the operation of the apparatus involving that group of cards, i.e., the forming of that group of cards into hands of random cards, comprises a new cycle. Each cycle is unique and is effected by the microprocessor, which microprocessor is programmed with software to include random number generating capability. The software assigns a number to each card and then randomly selects or correlates a compartment to each number. Under the control of the microprocessor, the elevator aligns the selected compartment with the card feed mechanism in order to receive the next card. The software then directs each numbered card to the selected slot by operating the elevator motor to position that slot to receive a card.

[0076] The present technology also describes a unique method and component of the system for aligning the feed of cards into respective compartments and for forming groups of randomly arranged cards. The separators between compartments may have an edge facing the direction from which cards are fed, that edge having two acute angled surfaces (away from parallelism with the plane of the separator) so that cards may be deflected in either direction (above/below, left/right, top/bottom) with respect to the plane of the separator. When there are already one or more cards within a compartment, such deflection by the edge of the separator may insert cards above or below the card(s) in the compartment. The component that directs, moves, and/or inserts cards into the compartments may be controllably oriented to direct a leading edge of each card towards the randomly selected edge of a separator so that the card is inserted in the randomly selected compartment and in the proper orientation (above/below, left/right, top/bottom) with respect to a separator, the compartments, and card(s) in the compartments. The addition of the separators to each compartment is believed to increase the randomness in an order of cards within a hand.

[0077] The apparatus of the present technology is compact, easy to set up and program and, once programmed, can be maintained effectively and efficiently by minimally trained personnel who cannot affect the randomness of the card delivery. This means that the machines are more reliable in the field. Service costs are reduced, as are assembly costs and set up costs. The preferred device also has fewer parts, which should provide greater reliability than known devices.

[0078] Other features and advantages of the present invention will become more fully apparent and understood with reference to the following specification and to the appended drawings and claims.

[0079] A desirable element in this practice of the described technology is assurance of randomness and the lack or predictability in the event of providing and assigning hands of different numbers of cards to players and/or to dealers. This is why some random determination (as with a random number generator, including both hardware and/or software, internal to the shuffler or provided from an external source) of the frequency and position, and even number of cards is desirable. For example, it would be undesirable, but possible, especially where there is a full table (and possibly only where there is a full table) to provide a player hand with a different number of cards every ten hands, or on average every ten hands (or any other specific number). If players know that every tenth hand will have more cards (at a table or for a player), betting strategy would be greatly altered, usually to the disadvantage of the casino. Therefore, randomness may or should be applied to how frequently a different number of cards is to be provided, the number difference that will be available (e.g., in a five-card game, whether 0, 1, 2, 3, 4, 5, 6, 7, 8, or 9 of cards, or fewer or more cards, are to be provided to hands with different number of cards), whether a player or whether a particular player or the dealer, or only among players is to receive the hand with the different number of cards. Once these concepts have been developed and considered as in this patent, the application of random number generation to these features by software and/or hardware can be performed by the skilled artisan.

[0080] A method is provided for randomly mixing cards comprising: a) providing at least one deck of playing cards;

b) removing cards one at a time from the at least one deck of cards; c) randomly inserting each card removed one at a time into one of a number of distinct storage areas, each storage area defining a distinct subset of cards; d) randomly determining a number of cards to form at least one distinct subset of cards such that at least one of the storage areas receives at least two randomly inserted cards one at a time to form a random, distinct subset of at least two cards, and the total number of cards within the random, distinct subset of at least two cards was randomly selected from within a range of numbers of cards or parameters.

[0081] The terminology “range of parameters” indicates that the selection is not, and cannot be, between zero and infinity in a card game. The uppermost end of the range cannot exceed the total number of cards in the at least one deck, and cannot exceed a number of cards that would prevent other players and a dealer, where present, from receiving a necessary number of cards to play in the underlying card game. For example, with seven players and a dealer in a five-card stud poker game, each player and a dealer may receive five cards, using a total of 40 cards out of the 52 cards in a standard 52-card poker deck. There are still 12 cards available, above the absolutely necessary 40 cards with seven players and a dealer, so the limits on possible numbers of cards within which the number may be randomly chosen are theoretically between zero (cannot deal fewer than zero cards) and 17 cards (the five original cards basic to the game and the 12 remaining cards). It is possible that if more than one hand may be randomly selected within a round of play and fewer than five cards may be dealt, that the range could exceed 17 cards, but the concept of the limits of the range is still clear.

[0082] A method is provided for randomly mixing cards comprising: a) providing at least one deck of playing cards; b) removing cards one at a time from the at least one deck of cards; c) randomly inserting each card removed one at a time into one of a number of distinct storage areas, each storage area defining a distinct subset of cards; d) at least one of the storage areas receiving at least two randomly inserted cards one at a time to form a random, distinct subset of at least two cards, the distinct subset of at least two cards is provided to players or a dealer, and the number of cards in the subset is randomly chosen from within a range of a number of cards.

[0083] Cards in random, distinct subsets may be removed from at least one of the distinct storage areas. The cards removed from at least one of the distinct storage areas may define a subset of cards that is delivered to a player as a hand. One set of the cards removed from at least one of the distinct storage areas may also define a subset of cards that is delivered to a dealer as a hand. Distinct subsets of cards may be removed from at least one distinct storage area and be delivered into a receiving area. Each distinct subset of cards may be removed from the storage area and delivered to a position on a gaming table that is distinct from a position where another removed subset is delivered. All removed subsets may be delivered to the storage area without removal of previous subsets being removed from the receiving area. At least two received subsets each may become hands of cards for use in a game of cards.

[0084] Referring to the figures, particularly FIGS. 1 and 2, one of the underlying card handling apparatus 20 useful in the present invention includes a card receiver 26 for receiving a group of cards, a single stack of card receiving

compartments 28 (see FIG. 2) generally adjacent to the card receiver 26, a card moving or transporting mechanism 30 between and linking the card receiver 26 and the compartments 28, and a processing unit, indicated generally at 32, that controls the apparatus 20. The apparatus 20 includes a second card moving mechanism 34 (see FIG. 2) for emptying the compartments 28 into a second card receiving platform 36.

[0085] Referring now to FIG. 1, the card handling apparatus 20 includes a removable, substantially continuous exterior housing, casing or shroud 40. The exterior design features of the device of the present invention are disclosed in U.S. Design Pat. No. D414,527. The shroud or casing 40 may be provided with appropriate vents 42 for cooling, if needed. The card receiver or initial loading region, indicated generally at 26, is at the top, rear of the apparatus 20, and a deck, card or hand receiving platform 36 is at the front of the apparatus 20. The platform 36 has a surface 35 for supporting a deck, card or hand. The surface 35 allows ready access by a dealer or player to the deck, card or hand handled, shuffled or discharged by the apparatus 20. Surface 35, in one example of the present invention, lies at an is angle with respect to a base 41 of the apparatus 20. That angle is preferably approximately 5° with respect to the horizontal, but may also conveniently be at an angle of from 0° to up to ±60V with respect to the base 41, to provide convenience and ergonomic considerations to the dealer. Control inputs 44 and/or display features 44 are generally located toward the rear or dealer-facing end of the apparatus 20.

[0086] The front of the shuffler 20 has a card stop 204 in the tray 36 which also has a card slide 143. An optional card reader 212 may be under the tray 36. The intermediate rack assembly 28. The rack assembly 28 is operably mounted to the apparatus 20 by a left-side rack plate 107 and a linear guide 108. The rack assembly 28 is attached to the guide 108 by means of a guide plate 110. The timing belt 82 is driven by the motor 80 and engages a pulley 112 for driving the rack assembly 28 up and down. A Hall effect switch assembly 114 is provided to sense the location of the rack assembly 28. The rack assembly 28 may include a card present sensor 116 mounted to an underside of the rack assembly housing 78 and which is electrically linked to the microprocessor.

Card Receiver

[0087] The card receiver or card loading region 26 includes a card receiving well 60. The well 60 is defined by upright, generally parallel card guiding sidewalls 62 (although one or both sidewalls 62 may be sloped inwardly to guide the cards into position within the well 60) and a rear wall 64. The card loading region 26 includes a floor surface 66 that, in one example of the present invention, is preferably pitched or angled downwardly toward the front of the apparatus 20. Preferably, the floor surface 66 is pitched from horizontal at an angle ranging from approximately 5 degrees to 20 degrees, with a pitch of about 7 degrees being preferred. A removable, generally rectangular weight or block 68 is generally freely movably is received in the well 60 for free forward and rearward movement along the floor surface 66. Under the influence of gravity, the block 68 will tend to move toward the forward end of the well 60. The block 68 has an angled, card contacting front face 70 for contacting the face (i.e., the bottom of the bottommost card) of the last card in a group of cards placed into the well 60,

and urges cards (i.e., the top card of a group of cards) forward into contact with the card transporting mechanism 30. The card contacting face 70 of the block 68 is at an angle complimentary to the floor surface 66 of the well 60, for example, an angle of between approximately 10 degrees and 80 degrees, and this angle and the weight of the block keep the cards urged forwardly against the transporting mechanism 30. In one embodiment, card contacting face 70 is rough and has a high coefficient of friction. The selected angle of the floor surface 66 and the weight of the block 68 allow for the free-floating rearward movement of the cards and the block 68 to compensate for the forces generated as the transporting mechanism 30 contacts the front card to move it. In another embodiment, a spring is provided to maintain tension against block 68. As shown in FIG. 2, the well 60 includes a card present sensor 74 to sense the presence or absence of cards in the well 60. The game content display 32 is light powered by LEDs 56.

[0088] One format of shuffling device, but not the only format of shuffling device, that can be used in the described technology may comprise a generally vertical stack of horizontally disposed card receiving compartments generally adjacent to the card receiver (the vertical stack generally is vertically movable), an elevator for raising and lowering the stack, a card moving mechanism between the card receiver and the stack for moving cards, one at a time, from the card receiver to a selected card receiving compartment, and a microprocessor that controls the card moving mechanism and the elevator so that each card in the group of unshuffled cards is placed randomly into one of the card receiving compartments. Sensors monitor and may trigger at least certain operations of the apparatus, including activities of the microprocessor, card moving mechanisms, security monitoring, and the elevator. The controlling microprocessor, including software, randomly selects or identifies which slot or card receiving compartment will receive each card in the group before card handling operations begin. For example, a card designated as card 1 may be directed to a first specifically nominally numbered slot (numbered here by numeric position within an array of slots), a card designated as card 2 may be directed to a nominally numbered different slot, a card designated as card 3 may be further directed to a third nominally numbered slot, etc.

Card Receiving Compartments

[0089] A rack assembly 28 is housed in an elevator and rack assembly housing 78 generally adjacent to the well 60, but horizontally spaced therefrom (see FIG. 2). An elevator motor 80 is provided to position the rack assembly 28 vertically under control of a microprocessor, which microprocessor is generally part of the processing unit 32. The assembly could also be a carousel-type or fan-type compartment assembly. The motor 80 is linked to the rack assembly 28 by a timing belt 82.

[0090] Preferably, the rack assembly 28 has nine compartments 106. Seven of the nine compartments 106 are for forming player hands, one compartment 106 forms dealer hands and the last compartment 106 is for accepting unused or discard cards. It should be understood that the device the present invention is not limited to a rack assembly 28 with seven compartments 106. For example, although it is possible to achieve a random distribution of cards delivered to eight compartments with a fifty-two card deck or group of cards, if the number of cards per initial is unshuffled group

is greater than fifty-two, more compartments than nine may be provided to achieve sufficient randomness in eight formed hands. Also, additional compartments may be provided to form hands for a gaming table having more than seven player positions. For example, some card rooms and casinos offer stud poker games to up to twelve people at a single table. The apparatus may then have thirteen compartments, as traditional poker does not permit the house to play, with one compartment dedicated to collect unused cards.

[0091] In each example of the present invention, at least one stack of unused cards is formed, which may not be sufficiently randomized for use in a card game. These unused cards should be returned to the card receiver for distribution in the next cycle.

[0092] The rack assembly 28 is operably mounted to the apparatus 20 by a left-side rack plate 107 and a linear guide 108. The rack assembly 28 is attached to the guide 108 by means of a guide plate 110. The timing belt 82 is driven by the motor 80 and engages a pulley 112 for driving the rack assembly 28 up and down. A Hall effect switch assembly 114 is provided to sense the location of the rack assembly 28. The rack assembly 28 may include a card present sensor 116 mounted to an underside of the rack assembly housing 78 (see FIG. 2) and which is electrically linked to the micro-processor.

Card Moving Mechanism

[0093] In a preferred embodiment, the pick-up roller 150 is not continuously driven, but rather indexes and includes a one-way clutch mechanism. After initially picking up a card and advancing it into the pinch roller system 160, the motor 154 operably coupled to the pick-up roller 150 stops driving the roller 150, and the roller 150 free-wheels as the card is accelerated through the pinch roller system 160. The speed-up pinch roller system 160 is preferably continuous in operation once a hand-forming cycle starts and, when a card is sensed by the adjacent card-out sensor 176, the pick-up roller 150 stops and free wheels while the card is accelerated through the pinch roller system 160. When the trailing edge of the card is sensed by the card-out sensor 176, the rack assembly 28 moves to the next position for the next card and the pick-up roller 150 is re-activated.

[0094] Referring to FIG. 2, the transporting mechanism 170 includes a pair of generally rigid stopping plates including an upper stop plate and a lower stop plate, 180, 182, respectively. The plates 180, 182 are positioned between the rack assembly 28 and the speed-up system 160 immediately forward of and above and below the pinch rollers 162, 164. The stop plates 180, 182 stop the cards from rebounding or bouncing rearwardly, back toward the pinch rollers 162, 164, as they are driven against and contact the gate 144 and/or the stop 142 at the front of the rack assembly 28.

[0095] A preferred card transporting or moving mechanism 30 is positioned between the card receiving well 60 and the compartments 106, 120 of the rack assembly 28 and includes a card pick-up roller assembly 149. The card pick-up roller assembly 149 includes a pick-up roller 150 and is located generally at the forward portion of the well 60. The pick-up roller 150 is supported by a bearing-mounted axle 152 extending generally transversely across the well 60 whereby the card contacting surface of the roller 150 is in close proximity to the forward portion of the floor surface 66. The roller 150 is driven by a pick-up motor 154 operably coupled to the axle 152 by a suitable continuous connector

156 such as a belt or chain. In operation, the front card in the well 60 is urged against the roller 150 by block 68 that when the roller 150 is activated, the frictional surface draws the front card downwardly and forwardly.

[0096] Referring now to FIG. 2, the preferred card transporting mechanism 30 also includes a pinch roller card accelerator or speed-up system 160 located adjacent to the front of the well 60 between the well 60 and the rack assembly 28 and forwardly of the pick-up roller 150. The speed-up system 160 comprises a pair of axle-supported, closely adjacent speed-up rollers, one above the other, including a lower roller 162 and an upper idling roller 164. The upper idling roller 164 is urged toward the lower roller 162 by a spring assembly 166. Alternatively, it may be weighted or drawn toward the lower roller by a resilient member (not shown). The lower roller 162 is driven by a speed-up motor 167 operably linked to the driven lower roller 162 by a suitable connector 168 such as a belt or a chain. A mounting bracket 170 for the speed-up rollers 162, 164 also supports a rearward card-in sensor 174 and a forward card-out sensor 176.

[0097] In another embodiment, the pick-up roller 150 is not continuously driven, but rather indexes and includes a one-way clutch mechanism. After initially picking up a card C and advancing it into the pinch roller system 160, the motor 154 operably coupled to the pick-up roller 150 stops driving the roller 150, and the roller 150 free-wheels as the card C is accelerated through the pinch roller system 160. The speed-up pinch roller system 160 is preferably continuous in operation once a hand-forming cycle starts and, when a card is sensed by the adjacent card-out sensor 176, the pick-up roller 150 stops and free wheels while the card is accelerated through the pinch roller system 160. When the trailing edge of the card is sensed by the card-out sensor 176, the rack assembly 28 moves to the next position for the next card and the pick-up roller 150 is re-activated.

Processing/Control Unit

[0098] A series of instructions may be stored in the controller as program logic. Preferred instructions include a random number generator executed in hardware, software or is a combination thereof that randomly selects a) a hand to receive fewer or more cards than a pre-programmed or base number of cards and b) the number of extra or fewer cards to be dispensed. The instructions may include frequency of such random events, and when cards are dealt to a known number of positions at a table (e.g., known by either dealing to all positions in pai gow poker, or to a specific number of positions where players and dealer are known to be in a particular round of the game), the instructions may include random selection of positions for receiving hands. In a preferred embodiment, the program logic is RAM or ROM hardware in the peripheral device 382. (Since the processing unit may have some memory capacity, it is possible that some or all of the instructions may be stored in the processing unit.) As one skilled in the art will recognize, various implementations of the program logic are possible. The program logic could be either hardware, software, or a combination of both. Hardware implementations might involve hardwired code or instructions stored in a ROM or RAM device. Software implementations would involve instructions stored on a magnetic, optical, or other media that can be accessed by the processing unit. Under certain conditions, it is possible that a significant amount of elec-

trostatic charge may build up in the card handling apparatus. Significant electrostatic discharge could affect the operation of the card handling apparatus. It is preferable to isolate some of the circuitry of the control system from the rest of the machine. In a preferred embodiment of the present invention, a number of optically coupled isolators are used to act as a barrier to electrostatic discharge.

Second Card Moving Mechanism

[0099] Referring to FIG. 2, the apparatus 30 includes a second card moving mechanism 34 comprising a reciprocating card compartment-unloading pusher 190. The pusher 190 includes a substantially rigid pusher arm 192 in the form of a rack having a plurality of linearly arranged apertures 194 along its length. The arm 192 operably engages the teeth of a pinion gear 196 driven by an unloading motor 198, which is in turn controlled by the controller (not shown). At its leading or card contacting end, the pusher arm 192 includes a blunt, enlarged card contacting end portion. The end portion is greater in height than the space between the shelf members forming the compartments to make sure that all the cards (i.e., the hand) contained in a selected compartment are contacted and pushed out as it is operated, even when the cards are bowed or warped. The second card moving mechanism 34 is operated intermittently (upon demand or automatically) to empty full compartments 106 at or near the end of a cycle.

[0100] FIG. 2 (PRIOR ART) from U.S. Pat. No. 8,267,404 is a largely representational view depicting the apparatus 20 and the relationship of its components including the card receiver 26 for receiving a group of cards for being formed into hands, including the well 60 and block 68, the rack assembly 28 and its single stack of card receiving compartments 106, 120, the card moving or transporting mechanism 30 between and linking the card receiver 26 and the rack assembly 28, the pusher 190 for emptying the compartments 106, 120, and the second card receiving platform 36 for receiving hands of cards.

[0101] A further structural alternative includes A playing card randomization system flush-mounted to a gaming table top having an outer edge having:

[0102] a) a playing card randomization system having a shuffling zone;

[0103] b) on one side of the shuffling zone is a playing card insertion area comprising a playing card support surface at a first elevation with respect to a highest level within the randomization system;

[0104] c) associated with the playing card support surface is a playing card mover that moves individual playing cards from the playing card support surface one-at-a-time into a first side of the shuffling zone;

[0105] d) a randomized playing card collection surface at a second elevation with respect to the randomization system;

[0106] e) the collection surface at the second elevation being at least 5 centimeters lower than the playing card support surface with respect to the highest level within the randomization system;

[0107] f) an elevator supporting the playing card support surface;

[0108] g) the random playing card collection surface covered by the gaming table top or a moveable lid; and

[0109] h) a support base for the playing card support system extending beyond the outer edge of the gaming

table top so that the playing card insertion area is accessible from a vertical direction to insert playing cards.

[0110] The playing card randomization system shuffling zone may include a vertical stacked array of compartments into which compartments individual playing cards are inserted from the playing card support surface. The playing card randomization system may include a carousel array of compartments into which compartments individual playing cards are inserted from the playing card support surface. The playing card randomization system may have a moveable cover over the playing card collection area to allow access to randomized playing cards by hand or by an elevator that is upwardly moveable by force applied to the elevator, and there may be an elevator is present which is upwardly moveable only by manual force applied to a top end of the elevator, preferably with a handle on the top end of the elevator.

[0111] A preferred method includes the playing card randomization system wherein the playing card randomization system is supported on a sliding system selected from the group consisting of rollers and slides. The rollers may be in a groove or on a track supporting the playing card randomization system so that retraction of the is playing card randomization system exposes the playing card collection area for manual removal.

[0112] In a fixed or moveable playing card randomization system, there may be a moveable cover over the playing card collection area to allow access to randomized playing cards by hand or by an elevator that is upwardly moveable by force applied to the elevator.

[0113] Again, in the preferred playing card randomization system, the playing card randomization system is supported on a sliding system selected from the group consisting of rollers and slides.

[0114] The playing card randomization system with rollers on a track may support the playing card randomization system so that retraction of the playing card randomization system exposes the playing card collection area for manual removal and the playing card insertion area may have been previously exposed or can be exposed at the same time as the exposure of the playing card collection area.

[0115] The playing card randomization system may have glides on a track which support the playing card randomization system so that retraction of the playing card randomization system exposes the playing card collection area for manual removal. Again, a handle may be present to allow manual force to extract the playing card randomization system horizontally.

[0116] It is clear from the above-described examples and embodiments that a number of different shuffling mechanisms can be used to randomize the cards, either before or during hand randomization. For example, RANDOM EJECTION SHUFFLE devices (e.g., as disclosed in U.S. Pat. Nos. 6,722,974; 6,651,985; 6,299,167; 6,270,404; 6,165,069; 6,019,368; 5,676,372; and 5,584,483) could be used to randomize either all or part of the group of cards (e.g., one or more decks) to be shuffled, and then a hand of randomly determined numbers of cards could be formed by removing cards individually or as a group from the randomized all or part of the group, or by feeding random numbers of cards to a delivery tray. Other examples of useful formats of shufflers have been described above, including but not limited to U.S. Pat. No. 5,275,411 (Breeding), U.S. Pat. Nos. 6,655,684;

6,651,982; 6,651,981; 6,588,751; 6,588,750; 6,568,678; 6,325,373; 6,254,096; 6,149,154; 6,139,014; 6,068,258; and U.S. Pat. No. 5,695,189 (Breeding et al.); U.S. Pat. No. 6,659,460 and U.S. Patent Application Publication 2003/0071413A1 (Blaha et al.); and U.S. Pat. Nos. 5,683,085 and 6,267,248 (Johnson et al.). These embodiments include speeding up shuffling time and hand delivery time by having hands either simultaneously formed and shuffled or formed from a smaller sub-set of randomized/shuffled cards. These techniques eliminate or reduce the waiting for a complete group of cards to be randomized before hands are formed.

[0117] The device that either a) forms hands or b) forms hands and randomizes cards has a processor with one or more random number generators that can determine any of the following functions: a) the number of cards per hand; b) the frequency of occurrence of extra or fewer cards in a hand; c) the number of extra or fewer cards in a hand; d) a location to which to deliver each card; etc. The random number generator (RNG) may be programmed or hard-wired to operate within certain parameters, such as random frequency but no more often than every 100 hands; random numbers of cards, but no more than X cards and no fewer than Y cards, etc.

[0118] Specific devices within the generic scope of the disclosed technology can advantageously be used to provide new and exciting features to a card game based on the chance or random occurrence of fewer or extra cards to a player, dealer, is community cards or combinations of the three.

[0119] Prior to the use of a random number generator to determine the number of cards in a hand, it was not even possible to offer such games, except if one had used an external device such as a prize wheel (also known as a candy wheel) to determine the random events such as player/dealer/community card positions and the number of cards to be received. Applicants are not aware of even that existence in commercial practice. Using such a device would provide security risks and potential for abuse or fraud. For example, particularly good card(s) could be passed by the dealer, the spin of the wheel could be manipulated, and the like.

[0120] Although it is desirable to include the random number generating functionality within the shuffler, it is also possible to provide such a function in an external computer or in a separate intelligent component (such as a G-Mod) in network or other form of communication with the shuffler. For example, a gaming table might contain an automatic shuffler, hand forming device (integrated with or separate from the shuffler), a random number generator (RNG), and/or a plurality of bet sensors, each communicatively connected to an external micro-processor or field programmable gate array with network or system or individual component communication capability. The RNG could select a random number and transmit that number over a line or network to the shuffler to tell the shuffler when to dispense more or fewer cards and how many more or fewer cards to dispense.

[0121] The RNG function could also reside in a table game computer, pit computer or any other on-line or networked computer and be capable of sending instructions to the shuffler and/or hand-forming device.

[0122] The application has emphasized the conversion of existing tabletop shufflers into flush mounted shufflers, but the system and design also work as well, and event is more simply than a conversion. Some of the commercial shufflers

have non-flat tops, so that an inside surface of the top of the shell **114** would have to be contoured to be flush or at least safely secured against the top **140** of the shuffler (easily seen in FIG. **1** for the curved top surface).

[0123] FIG. **04A** is a side view of a casing **119** further useful in converting shufflers (as in FIG. **1** or FIG. **2** or using duplicated commercially available shufflers (as in FIG. **1** and FIG. **2**) to a flush-mounted table-embedded shuffler. The top **117** of the case **19** is flush with a gaming table top (not shown), again with “flush allowing for about ± 1 cm difference in height between the top of the table (not shown) and the top **17** of the housing **119**. The space **128a** is where an elevator (as previously shown) can optionally be positioned to assist in raising cards after randomization.

[0124] A base **121** of the housing **119** is supported to position the top **117** of the housing **119** flush with the table top (not shown). A side edge **123** of the Housing **119** is positioned to allow cards to be placed for randomization in the playing card introduction area **26**, and where all other common numbers (with previous figures have the same meaning. There may still be the cover or lid **116** to enable access to the randomized playing cards (not shown), but this construction allows entry of playing cards into area **26** without using any lid or cover or movement of the shuffler under and out of the table.

[0125] FIG. **04B** is a side view of a shuffler system **20** further useful in converting shufflers or using duplicated shufflers to a flush-mounted table-embedded shuffler in which the shuffler **20** is supported on rollers **406** or slides or glides (not shown, but substituted for the rollers **406** allowing the shuffler **20** to slide or glide over a support base or glides **408** so that the shuffler slides, rolls, glides or otherwise easily moves over a base to allow access to a front end **36** of the shuffler. A handle **402** is provided so that the dealer can pull on the shuffler **20** and slide it from under is the table top **400** to access the card removal system and tray (without an elevator), and in the solid line table top **400**, the playing card insertion area **26** is accessible without moving the shuffler, and where the table top dashed lines **400a** is provided, the length of the support is or may be longer than in FIG. **04A**, as both the card insertion area **26** and the card removal area **36** must both be exposed at one time or another for operation of the flush-mounted shuffler **20**.

[0126] By constructing the shuffling function shown in FIG. **5** with relatively flat exterior surfaces, the shell may be generally rectangular on all surfaces, so that a square hole may be made in a gaming table top (as is typical for flush-mounted shuffling elements) and a flat support under the table can support the entire device **20** with shell **110**.

What is claimed:

1. A playing card randomization system flush-mounted to a gaming table top having an outer edge comprising:
 - i) a playing card randomization system having a shuffling zone;
 - j) on one side of the shuffling zone is a playing card insertion area comprising a playing card support surface at a first elevation with respect to a highest level within the randomization system;
 - k) associated with the playing card support surface is a playing card mover that moves individual playing cards from the playing card support surface one-at-a-time into a first side of the shuffling zone;

- l) a randomized playing card collection surface at a second elevation with respect to the randomization system;
 - m) the collection surface at the second elevation being at least 5 centimeters lower than the playing card support surface with respect to the highest level within the randomization system;
 - n) an elevator supporting the playing card support surface;
 - o) the random playing card collection surface covered by the gaming table top or a moveable lid; and
 - p) a support base for the playing card support system extending beyond the outer edge of the gaming table top so that the playing card insertion area is accessible from a vertical direction to insert playing cards.
- 2) The playing card randomization system of claim 1 wherein the shuffling zone comprises a vertical stacked array of compartments into which compartments individual playing cards are inserted from the playing card support surface.
 - 3) The playing card randomization system of claim 1 wherein the shuffling zone comprises a carousel array of compartments into which compartments individual playing cards are inserted from the playing card support surface.
 - 4) The playing card randomization system of claim 2 wherein there is a moveable cover over the playing card collection area to allow access to randomized playing cards by hand or by an elevator that is upwardly moveable by force applied to the elevator.
 - 5) The playing card randomization system of claim 4 wherein the elevator is present and is upwardly moveable only by manual force applied to a top end of the elevator.
 - 6) The playing card randomization system of claim 5 wherein there is a handle on the top end of the elevator.
 - 7) The playing card randomization system of claim 2 wherein the playing card randomization system is supported on a sliding system selected from the group consisting of rollers and slides.
 - 8) The playing card randomization system of claim 7 wherein rollers on a track support the playing card randomization system so that retraction of the playing card randomization system exposes the playing card collection area for manual removal.
 - 9) The playing card randomization system of claim 3 wherein there is a moveable cover over the playing card collection area to allow access to randomized playing cards by hand or by an elevator that is upwardly moveable by force applied to the elevator.
 - 10) The playing card randomization system of claim 9 wherein the elevator is present and is upwardly moveable only by manual force applied to a top end of the elevator.
 - 11) The playing card randomization system of claim 10 wherein there is a handle on the top end of the elevator.
 - 12) The playing card randomization system of claim 9 wherein the playing card randomization system is supported on a sliding system selected from the group consisting of rollers and slides.
 - 13) The playing card randomization system of claim 12 wherein rollers on a track support the playing card randomization system so that retraction of the playing card randomization system exposes the playing card collection area for manual removal.
 - 14) The playing card randomization system of claim 12 wherein glides on a track support the playing card randomization system so that retraction of the playing card randomization system exposes the playing card collection area for manual removal.
 - 15) The playing card system of claim 7 wherein a handle is present to allow manual force to extract the playing card randomization system horizontally.
 - 16) The playing card system of claim 8 wherein a handle is present to allow manual force to extract the playing card randomization system horizontally.
 - 17) The playing card system of claim 12 wherein a handle is present to allow manual force to extract the playing card randomization system horizontally.
 - 18) The playing card system of claim 13 wherein a handle is present to allow manual force to extract the playing card randomization system horizontally.
 - 19) The playing card system of claim 14 wherein a handle is present to allow manual force to extract the playing card randomization system horizontally.

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