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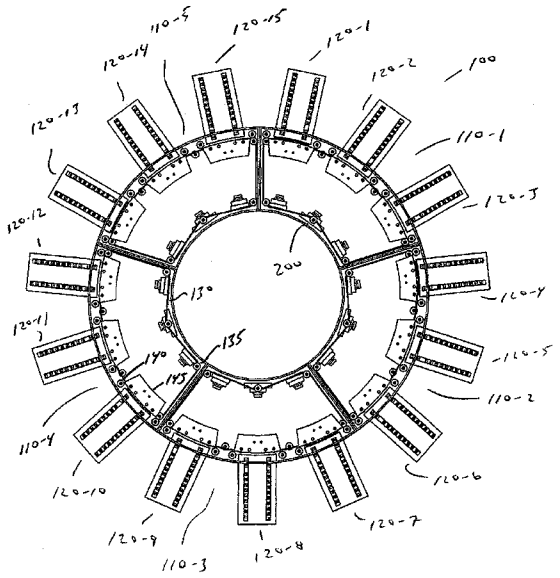
(54) Title: DEVICE FOR SORTING PLAYING CARDS AND METHODS OF USE



(57) Abstract: A playing card sorting device is disclosed. The device includes a series of storage bays adapted to hold playing cards. In one version the storage bays are configured in a circular arrangement. A series of rotating belts move cards between storage bays. At least one image capturing device captures playing card images so that the playing cards maybe sorted by suits and/or rank.

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DEVICE FOR SORTING PLAYING CARDS AND METHOD OF USE

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application No. 60/806,755 filed July 7, 2006.

FIELD OF THE INVENTION

[0002] The embodiments of the present invention relate to a device for sorting mixed cards into a desired order. For example, sorting one or more decks of mixed playing cards into an original packaged order.

BACKGROUND

[0003] Playing cards used in casino environments must be constantly reviewed or audited to determine whether the decks are complete. In one instance, there is the possibility that decks of playing cards received from the manufacturer or supplier are incomplete. In a second instance, during use within the casino environment, cards may be lost or additional cards may find there way into decks. Such problems, which usually arise from human error, can also be compounded by automated shuffling devices. Another reason for examining and sorting cards into original decks is for promotional purposes as casinos sell or give them away as souvenirs.

[0004] Certain current devices, including some automatic shufflers, are able to verify the number of cards without any reference to suit or rank of the cards while others are able to verify the number of cards and, in no particular order, the correct suit and rank of the cards. Indeed, some devices are able to sort cards but such devices suffer from serious drawbacks as detailed below. In other instances, cards are manually sorted. However, manually sorting cards results in increased costs and a greater likelihood of error.

[0005] Thus, there exists the need for an automated device capable of sorting cards while eliminating the drawbacks of prior devices and improving the veracity and speed of the sorting process.

SUMMARY

[0006] Accordingly a first device embodiment of the present invention comprises: at least one camera operable to capture item images; multiple modular sections each having multiple storage bays and an item transport device; and wherein the modular sections are configured so that the item transport device of each modular section is able to transport items between any two adjacent modular sections such that the items may be transported between any of the multiple storage bays in a pre-determined manner.

[0007] A first method embodiment of the present invention comprises: loading items into a loading storage bay in a first device section, said device section having multiple storage bays; capturing an image of the items; transporting the items to designated other storage bays based on pre-determined first sorting criteria, each designated other storage bay in a separate device section wherein each separate device section has multiple storage bays; sorting the items in each designated storage bay based on pre-determined second sorting criteria, said sorting facilitated by transporting the items located in the designated storage bays between the designated storage bay and other storage bays within the corresponding section containing the designated storage bay; and transporting the sorted items from each section to an unloading storage bay based on pre-determined criteria.

[0008] With playing cards, the cards are first sorted by suits into multiple separate device sections. Once the suits have been transported to a designated area, they are further sorted by rank. Therefore, simultaneously, all four card suits are being sorted by rank in a different device section. Once all suits are sorted by rank, the sorted ranked cards are transported in a pre-determined sequence, to an unloading area. While playing cards are used throughout this document to describe the embodiments of the present invention, other items may be sorted using the embodiments of the present invention as well.

[0009] Other variations, embodiments and features of the present invention will become evident from the following detailed description, drawings and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Fig. 1 illustrates a top view of one embodiment of the present invention;

[0011] Fig. 2 illustrates a perspective view of one section of the embodiment of the present invention illustrated in Fig. 1;

[0012] Fig. 3 illustrates a storage bay door having cutouts for use with the embodiment of the present invention shown in Figs. 1-2;

[0013] Fig. 4 illustrates a top view of an alternative embodiment of the present invention;

[0014] Fig. 5 illustrates a perspective view of one section of the alternative embodiment of the present invention;

[0015] Figs. 6a-6e illustrate operation of the alternative embodiment of the present invention;

[0016] Fig. 7 illustrates the top view as shown in Fig. 1 to detail the method of using the embodiments of the present invention; and

[0017] Fig. 8 illustrates a flow chart detailing the method of operation of the embodiments of the present invention.

DETAILED DESCRIPTION

[0018] For the purposes of promoting an understanding of the principles in accordance with the embodiments of the present invention, reference will now be made to the embodiments illustrated in the drawings and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended. Any alterations and further modifications of the inventive features illustrated herein, and any additional applications of the principles of the invention as illustrated herein, which would occur to one skilled in the relevant art and having possession of this disclosure, are to be considered within the scope of the invention claimed.

[0019] The embodiments of the present invention relate to a processor- and software-controlled device for sorting items including standard playing cards. The processor and software may take many forms suitable for controlling the operations of the device. Those skilled in the art will understand that processors and software are well-known in the art and capable of being implemented in any number of configurations. A user interface, comprising at least a display and input means (e.g., button panel or touch screen), allows an operator to input device instructions and/or receive device feedback.

[0020] Initial reference is made to Fig. 1 illustrating a card sorting device generally referred to by reference numeral 100. As shown, the device 100 comprises five modular sections 110-1 through 110-5. Each section 110-1 through 110-5 is generally identical but may operate differently based on the processor and software configured to control the device 100. Each section 110-1 through 110-5 comprises three card storage bays 120, one or more belts 130 driven by one or more powered rollers 135 and guided by one or more passive rollers 140 and roller mounts 145. In one exemplary embodiment, two vertically spaced belts 130 are used to transport cards. The roller mounts 145 are positioned along an inner wall 150 of the device 100 and spaced such that a roller mount 145 is secured in front of each storage bay 120-1 through 120-15. One or more motors (not shown) drive the powered rollers 135 in either direction. The one or more motors may be positioned in each section 110-1 through 110-5 or may be centrally located. Regardless of the configuration of the motors, the motors are controlled by the one or more processors (not shown) and software which additionally control other device 100 operations and components as detailed hereinafter.

[0021] The storage bays 120-1 through 120-15 accept cards in an upright or vertical configuration but with different storage bay designs the storage bays may accept cards in a sideways or horizontal configuration as well. Initially, a stack of mixed cards 142 is placed into an input storage bay with the card faces, for reasons detailed below, directed toward a center of the device 100. Each of the storage bays 120-1 through 120-15 include lips 155 along a bottom and top edge near a card entrance and exit to prevent the cards 142 from unintentionally

exiting the storage bays 120-1 through 120-15 after they are loaded or directed therein. Slots along vertical edges of the storage bays 120-1 through 120-15 near the card entrance and exit and behind the lips 155 allow cards 142 to enter and exit the storage bays 120-1 through 120-15. In addition, each storage bay 120-1 through 120-15 includes a static or dynamic pressure plate 165 operable to apply pressure to a back of the cards in a direction toward the storage bay entrance or exit and the one or more belts 130.

[0022] Now referring to Figs. 1 and 2, in one embodiment, a storage bay door 170, rotatable about a vertical, center axis point 175, acts as a gatekeeper for each storage bay 120-1 through 120-15. In this embodiment, each storage bay door 170 includes one or more cutouts 180 (Fig. 3) corresponding to the position of the one or more belts 130. When desired, a first card 142-1 in the stack is pulled from a storage bay 120-1 through 120-15 by rotating the subject storage bay door 170 in the appropriate direction commensurate with the rotational direction of the one or more belts 130 and moving the dynamic pressure plate 165 against the stack of cards 142, or moving the storage bay 120-1 through 120-15, in the direction of the one or more belts 130. Once the first card 142-1 makes contact with the one or more rotating belts 130 through the cutouts 180, it is pulled past the storage bay door 170 through one of the slots and transported to, and deposited in, another storage bay 120-1 through 120-15 (storage bay 120-2 as shown) as described below. An optional card guide 185 circumscribes a lower portion of the device 100 through each section 110-1 through 110-5 and accepts a lower edge of card 142-1 guiding it to a desired storage bay 120-1 through 120-15. In one embodiment, the card 142-1 is transported by the one or more belts 130 between spaced rollers 135, 140 on each side thereof. As shown in Fig. 2, in this embodiment, when the card 142-1 reaches the appropriate storage bay 120-10 it is directed into the storage bay 120-10 by door 170 that has been slightly rotated to act as a ramp thereby directing the card 142-1 into the storage bay 120-10.

[0023] In another embodiment, as shown in Figs. 4 and 5, the storage bays 120-1 through 120-15 are not fitted with doors 170. In this embodiment, solenoids 190 corresponding to each storage bay 120-1 through 120-15 are

secured to the roller mounts 145. As shown in Figs. 6a through 6e, a card 142-1 is loaded into a subject storage bay 120-2 by pushing the card with a solenoid plunger 195 into the subject storage bay 120-2. Fig. 6a shows the card 142-1 in position in a front portion of the storage bay 120-2 with the solenoid 190-2 in a home position. Fig. 6b shows the activated solenoid 190-2 pushing the card 142-1 into the storage bay 120-2 past lips 155 causing the card 142-1 to slightly bend. Fig. 6c shows the card 142-1 in the storage bay 120-2, past the lips 155 and no longer bent. The solenoid 190-2 is fully extended at this stage. Fig. 6d shows the card 142-1 forced against the lips 155 by the pressure plate 165 and the solenoid 190-2 again at its home position. Fig. 6e shows the storage bay 120-2 moved toward the one or more rotating belts 130 such that the card 142-1 contacts the one or more belts 130 causing the card 142-1 to exit the storage bay 120-2. Appropriate mechanisms, such as de-doublers, common in material moving machinery prevent more than one card at a time from exiting the storage bay.

[0024] In any embodiment of the present invention, one or more cameras 200, or similar image capturing devices, are positioned within the device 100. In one embodiment, a camera 200 is positioned across from each storage bay 120-1 through 120-15. In another embodiment, a camera 200 is positioned across from only an initial card-receiving storage bay or input storage bay. The one or more cameras 200 capture, using OCR technology or similar video analysis and recognition technology, the rank and suit of the cards 142 as they exit the input storage bay and/or are transported from storage bay 120-1 through 120-15 to storage bay 120-1 through 120-15 throughout the device 100. The captured rank and suit of the cards 142 is stored temporarily in RAM or the like for purposes of sorting the cards 142. For example, a camera 200 positioned across from the input storage bay may capture the rank and suit of the cards 142 as they exit the input storage bay. Other camera 200 placements may be utilized to capture the rank and suit of the cards 142 as well.

[0025] Now referring to Figs. 7 and 8, a method of operation of the embodiments of the present invention is detailed. Fig. 8 shows a flow chart 300 detailing a method of operation with reference to Fig. 7. Prior to operation of the

device 100, one storage bay is designated as the input storage bay 120-2 and four storage bays are designated as suit storage bays. Consequently, a spade, heart, club and diamond storage bay 120-5, 120-8, 120-11 and 120-14, respectively, are designated. Initially, at 310, a mixed stack of cards is placed into an input storage bay 120-2. The cards may be placed in the input storage bay 120-2 from the top, rear, front or bottom depending on the configuration. The mixed stack of cards may comprise one or more decks of standard playing cards. For this example, it is assumed that one standard deck of mixed playing cards is placed in the input storage bay 120-2. It will be recognized by those skilled in the art that any storage bay 120-1 through 120-15 may be designated as the input storage bay. At 320, the input storage bay 120-2 is moved toward the rotating belts 130 causing a first card to be pulled out of the input storage bay 120-2. At 330, a first card is pulled from the input storage bay 120-2 and at 340 the storage bay 120-2 is moved away from the one or more belts 130. At 350, a first card's rank and suit is captured by a camera 200 positioned across from the entrance and exit of the input storage bay 120-2. The captured rank and suit is analyzed by the processor and stored in temporary memory. At 360, based on the card suit, the first card is transported by the rotating belts 130 to a designated suit storage bay 120-5, 120-8, 120-11 and 120-14. The belts 130 are controlled by the processor and associated software in response to the captured card suit. The first card and each subsequent card is placed into a designated suit storage bay 120-5, 120-8, 120-11 and 120-14 by means of the door 170, solenoid 190 or other means. At 370, it is determined whether the input storage bay is empty. If not, as represented by the flowchart loop, each subsequent card is pulled from the input storage bay 120-2 and transported to a designated suit storage bay 120-5, 120-8, 120-11 and 120-14. Consequently, each designated suit storage bay 120-5, 120-8, 120-11 and 120-14 is provided thirteen playing cards comprising Ace through King of the suit in a random order.

[0026] With certain exceptions, each subsequent card may be pulled from the input storage bay 120-2 immediately after the previous card is pulled. However, cards must not be pulled so quickly that they overlap thereby preventing the one or more cameras 200 from capturing the rank and suit of

each pulled card. Also, as the one or more belts 130 may move in either direction, each subsequent pulled card should be clear of section 110-1 before a subsequent card is pulled from the input storage bay 120-2. That is, the one or more belts 130 in section 110-1 may need to be reversed to transport a subsequent card in an opposite direction thereby transporting the pulled card the shortest possible distance to the designated storage bay 120-5, 120-8, 120-11 and 120-14. So, as shown in Fig. 7, cards having suits of spades and hearts are moved in a clockwise direction to designated storage bays 120-5 and 120-8 while cards having clubs and diamonds are moved in a counter-clockwise direction to designated storage bays 120-11 and 120-14.

[0027] At 380, once the input storage bin 120-2 is empty as detected by a sensor or similar device, each section 110-2 through 110-5 containing a designated suit storage bay 120-5, 120-8, 120-11 and 120-14 begins sorting the thirteen cards. Cards are sorted in any pre-determined manner programmed into the device 100. However, in most instances the cards are sorted Ace through King or King through Ace which is the same order in which they were originally packaged. Each section 110-2 through 110-5 is able to sort the cards based on the previously captured card ranks. That is, the order of the cards in each designated suit storage bay 120-5, 120-8, 120-11 and 120-14 is known. Alternatively, the rank can be acquired in each section 110-2 through 110-5 during the sorting process. Therefore, using section 110-2 and designated suit storage bay 120-5 for purposes of illustration, cards are removed from designated suit storage bay 120-5 and placed in storage bay 120-4 until the Ace of spades is located. The Ace of spades is then transported to storage bay 120-6. Then, cards are pulled from, and transported between, storage bays 120-4 or 120-5 depending on which storage bay 120-4 or 120-5 contains the Two of spades. Once the Two of spades is located, it is transported to the storage bay 120-6 and placed on the Ace of spades. This process continues until the thirteen spades are in the pre-determined order in storage bay 120-6. Simultaneously, each other section 110-3 through 110-5 is sorting its thirteen cards in the same manner. At 390, each sorted suit of cards is transported to storage bay 120-2 in a pre-determined order (e.g., spades, hearts, clubs and

diamonds) for unloading. In one embodiment of the present invention, a card-canceling device can be operated at this point to mark the cards in such a manner as to render them un-usable in a casino environment. This may take the form of punching a hole in each card, clipping the corner of each card, or introducing an ink mark on the face or edge of each card. Optionally the card-canceling device may be present in each module and introduced to the sorting process at any time. At this stage the cards, in the pre-determined order, can be removed by an operator. Optionally, prior to removal of the sorted cards, jokers or other promotional type cards (e.g., instruction cards) pre-loaded in storage bays 120-1 and 120-3 may be transported to storage bay 120-2 so that they reside on a top and/or bottom of the sorted cards to form a complete deck as packaged originally.

[0028] While one deck is described herein, the device 100 may also sort multiple decks simultaneously. With multiple decks, deck separators in the form of paper, thin plastic or other suitable items may be placed in storage bays 120-1 or 120-3 so that once a sorted deck is received by storage bay 120-2, the deck separator may be transported to storage bay 120-2 to provide a clear demarcation of the each sorted deck.

[0029] Should the device detect a shortage of cards (less then a full deck) or a excessive cards (more than a full deck), the device alerts the operator. The device 100 may alert the operator as to the rank and suit of the missing card(s) or just the fact that a certain number of cards are missing. If one or more excessive cards are detected, the device 100 may transport them to a designated storage bay (e.g., 120-3) for retrieval by the operator.

[0030] The modular design of the device 100 allows simultaneous sorting operations to take place thereby speeding up the sorting process. The modular design also allows a defective or maintenance-ready module to be removed and replaced very quickly.

[0031] While certain storage bays 120-1 through 120-15 have been described herein as serving a particular function, it is apparent that storage bays 120-1 through 120-15 are interchangeable and may serve any number of

purposes (e.g., input or designated suit) as required by the specific function of the device 100.

[0032] It will be clear to those skilled in the art that the device 100 may also be used to mix or randomize cards. In other words, the device 100 may be programmed to function as an automatic shuffler.

[0033] Although the invention has been described in detail with reference to several embodiments, additional variations and modifications exist within the scope and spirit of the invention as described and defined in the following claims.

Claims:

1. An item sorting device comprising:

at least one camera operable to capture item images;

multiple modular sections each having multiple storage bays and an item transport device; and

wherein the modular sections are configured so that the item transport device of each modular section is able to transport items between any two adjacent modular sections such that the items may be transported between any of the multiple storage bays in a pre-determined manner.

2. The item sorting device of claim 1 wherein the items are playing cards.

3. The item sorting device of claim 2 wherein the device has five sections with each section having three storage bays.

4. The item sorting device of claim 2 further comprising at least one or more card canceling devices that may be enabled to cancel each card during the sorting operation.

5. The item sorting device of claim 1 further comprising a processor operable to control the device.

6. The item sorting device of claim 1 further comprising a user interface operable to permit an operator to input device instructions and/or receive device feedback.

7. The item sorting device of claim 1 wherein the item transport devices are bi-directional.

8. The item sorting device of claim 1 further comprising a standard computer interface allowing an external computer connected to the sorting device to

provide device instructions and/or receive sorting data and performance data from the sorting device.

9. An item sorting device comprising:

at least one camera operable to capture item images;

a series of storage bays configured adjacent to one another;

means for moving items between said series of storage bays;

a user interface including a display, said interface operable to permit an operator to input device instructions and/or receive device feedback; and

a processor for controlling the device such that items are sorted into one or more of the storage bays.

10. The item sorting device of claim 9 wherein the series of storage bays are configured in modules having two or more storage bays each.

11. The item sorting device of claim 10 further comprising five modules having three storage bays each.

12. The item sorting device of claim 11 wherein the storage bays are adapted to receive standard playing cards.

13. The item sorting device of claim 9 wherein the series of storage bays are configured in a circle.

14. The item sorting device of claim 9 wherein the means for moving items between said series of storage bays operates bi-directionally.

15. A playing card sorting device comprising:

at least one camera operable to capture playing card images;

a series of storage bays configured adjacent to one another in a circular configuration;

a card moving system for moving playing cards between said series of storage bays;

a user interface including a display, said interface operable to permit an operator to input device instructions and/or receive device feedback; and

a processor, in communication with said at least one camera, for controlling the device such that said playing cards are sorted into one or more of the storage bays.

16. A playing card sorting device comprising:

at least one camera operable to capture images of said playing cards; and

multiple modular sections each having multiple storage bays and a playing card transport device, said modular sections configured so that the item transport device of each modular section is able to transport said playing cards between any two adjacent modular sections such that the playing cards may be transported between any of the multiple storage bays in a pre-determined manner.

17. A method of sorting items comprising:

loading the items into a loading storage bay in a first device section, said device section having multiple storage bays;

capturing an image of the items;

transporting the items to designated other storage bays based on pre-determined first sorting criteria, each designated other storage bay in a separate device section wherein each separate device section has multiple storage bays;

sorting the items in each designated storage bay based on pre-determined second sorting criteria, said sorting facilitated by transporting the items located in the designated storage bays between the designated storage bay and other storage bays within the corresponding section containing the designated storage bay; and

transporting the sorted items from each section to an unloading storage bay based on pre-determined criteria.

18. The method of claim 17 wherein the items are playing cards.

19. The method of claim 17 wherein the first sorting criteria are card suits.

20. The method of claim 17 wherein the second sorting criteria are card ranks.

21. The method of clam 17 further comprising transporting the cards to a designated spade, heart, club and diamond designated storage bay.

22. A method of sorting playing cards comprising:

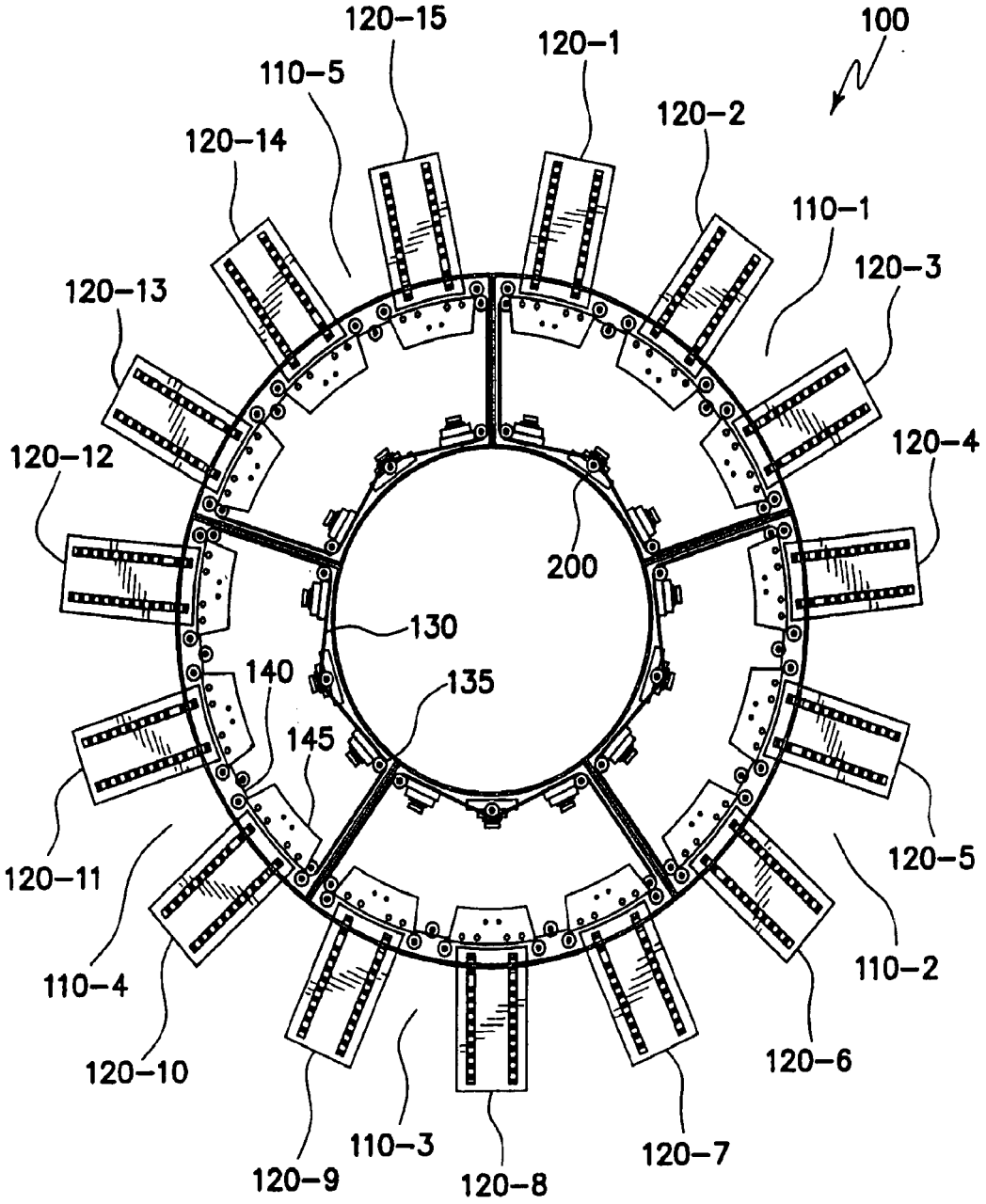
one by one removing from a designated loading storage bay a playing card from a group of mixed playing cards;

capturing an image of each playing card as it is removed from the designated loading storage bay; and

transporting the cards to a designated club, spade, diamond or heart storage bay depending on a suit of the card as captured by an image capturing device.

23. The method of claim 22 further comprising storing the order in which the playing cards are removed from the designated loading storage bay.

24. The method of claim 22 further comprising sorting by rank cards in each of said club, spade, diamond and heart storage bays by systematically removing and transporting cards between the club, spade, diamond and heart storage bays and empty storage bays adjacent to each of said club, spade, diamond and heart storage bays.


120–15
120–1
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110–5
120–2
120–14
110–1
120–3
120–13
120–4
120–12
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140
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145
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120–9
120–8

FIG. 1

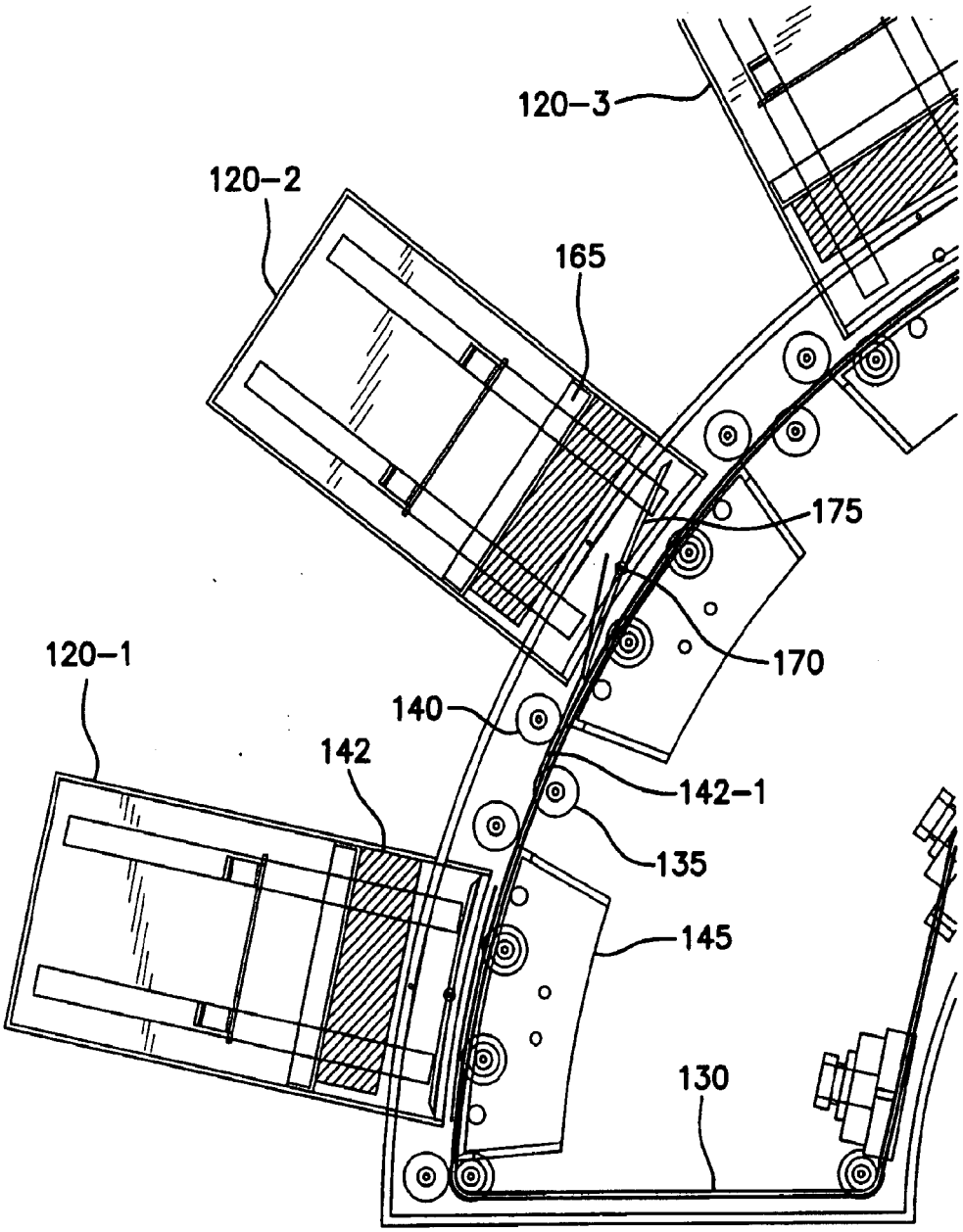


FIG. 2

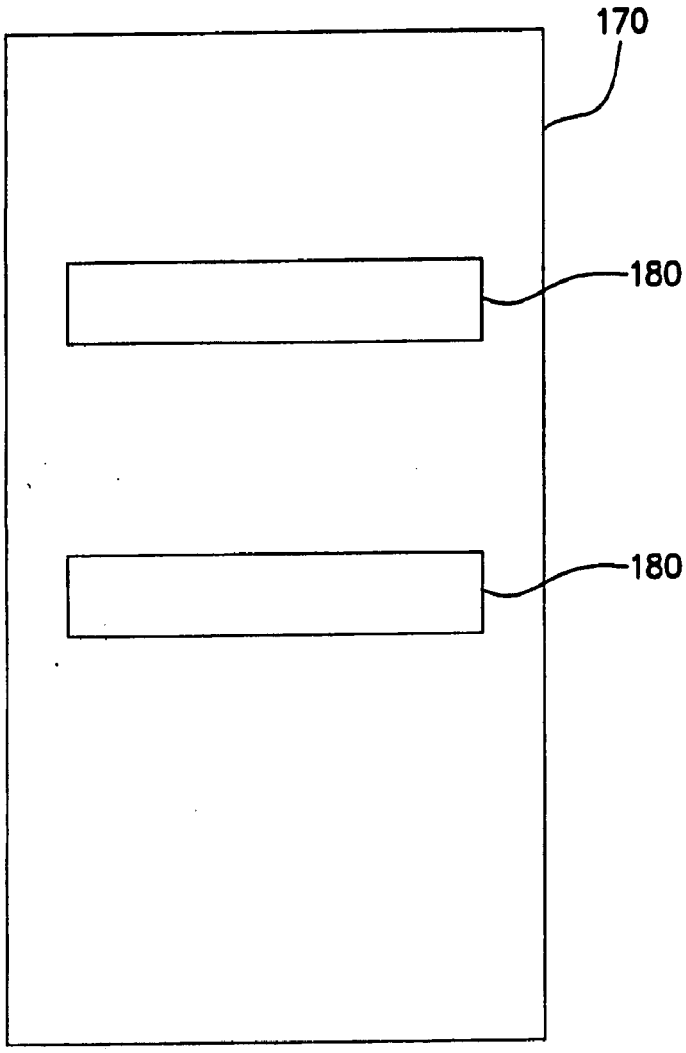


FIG. 3

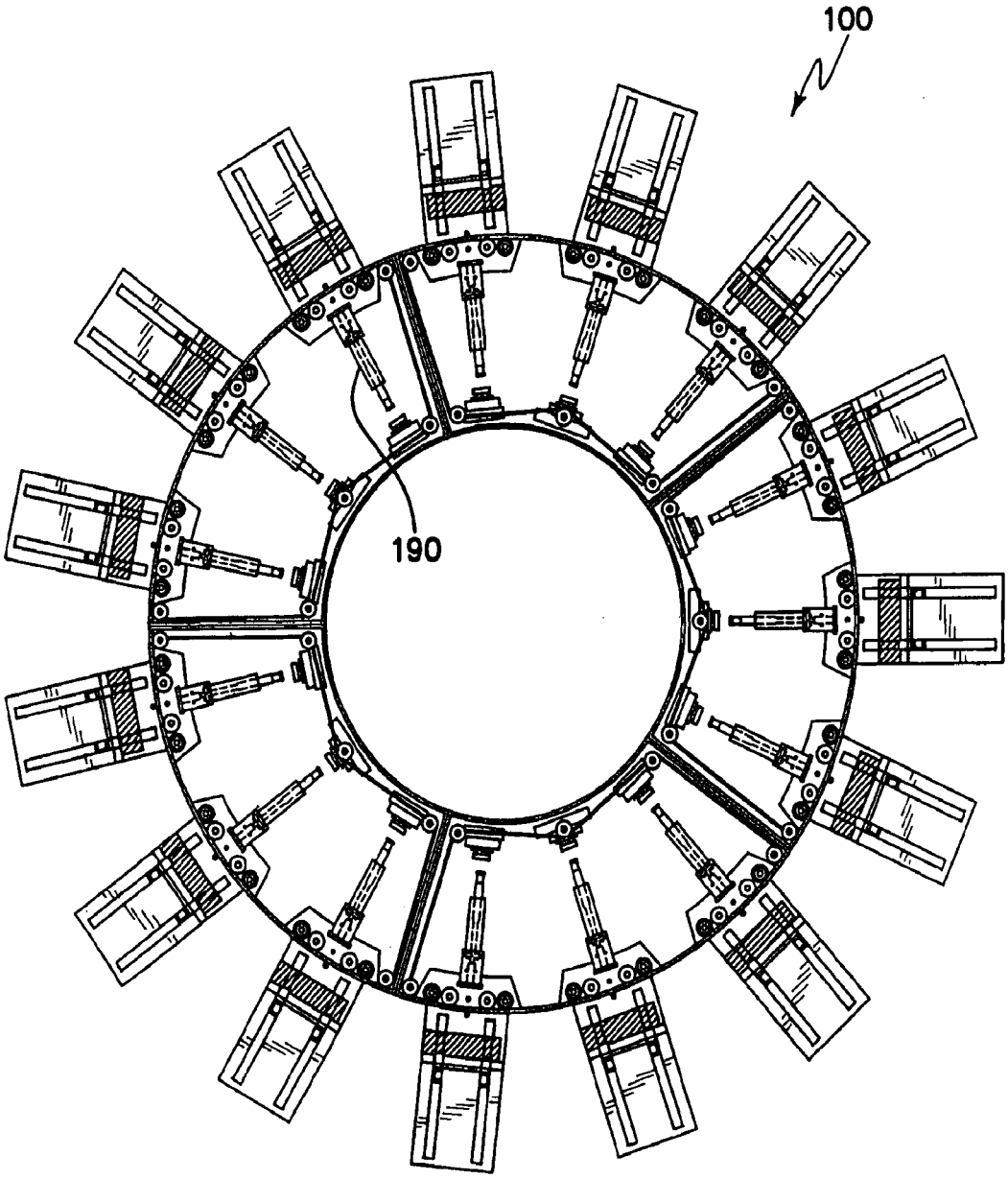
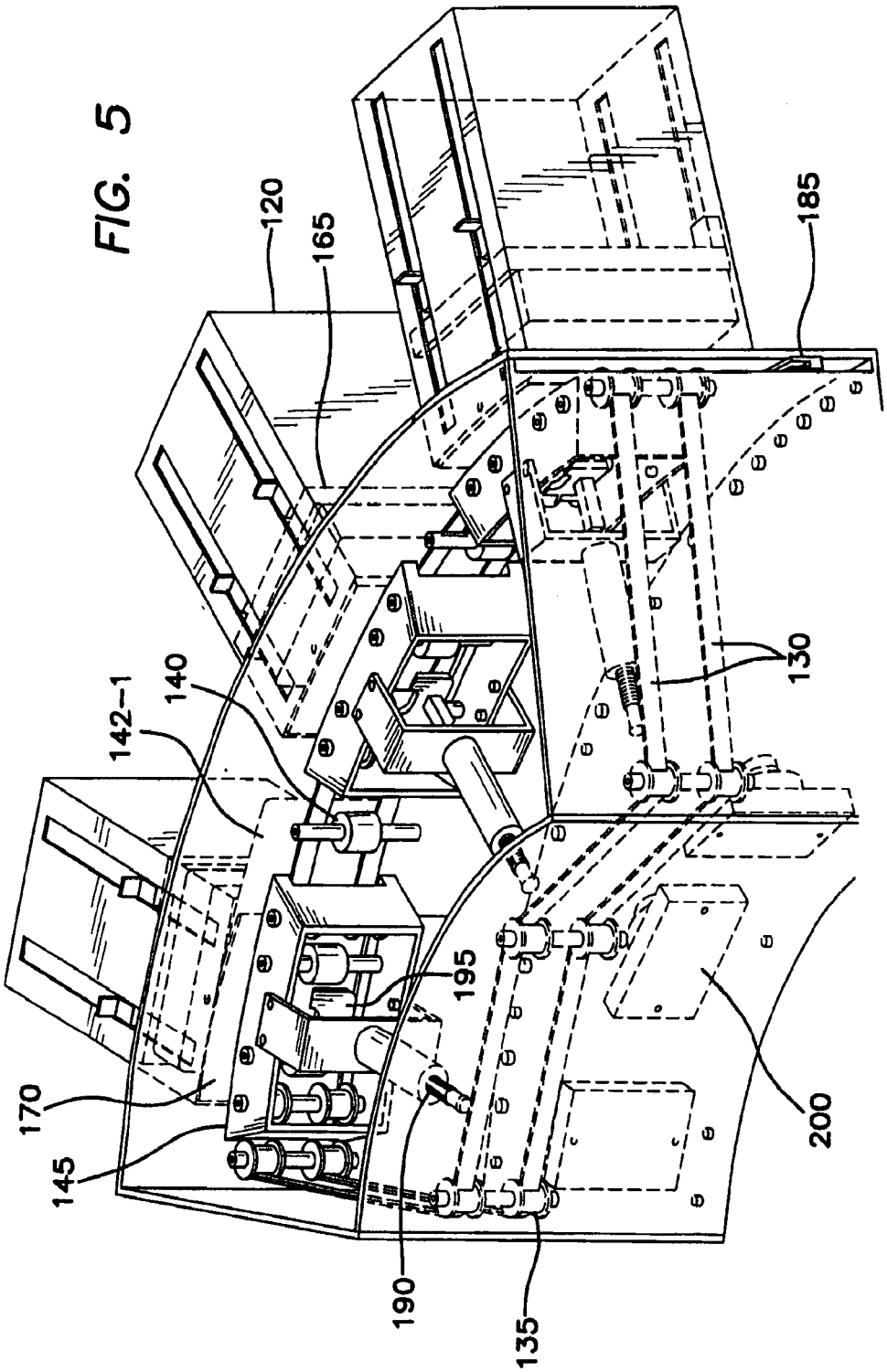


FIG. 4

FIG. 5



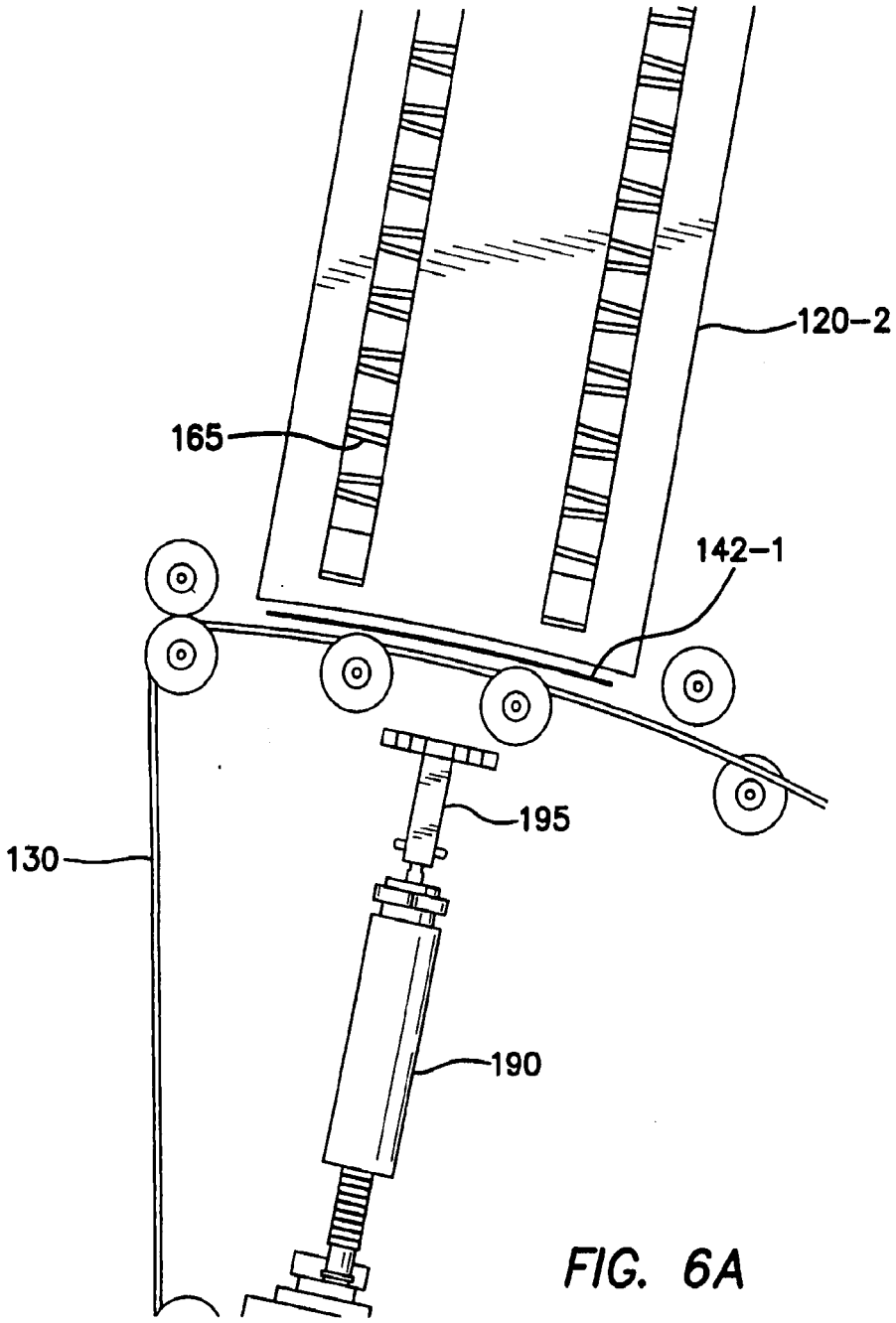


FIG. 6A

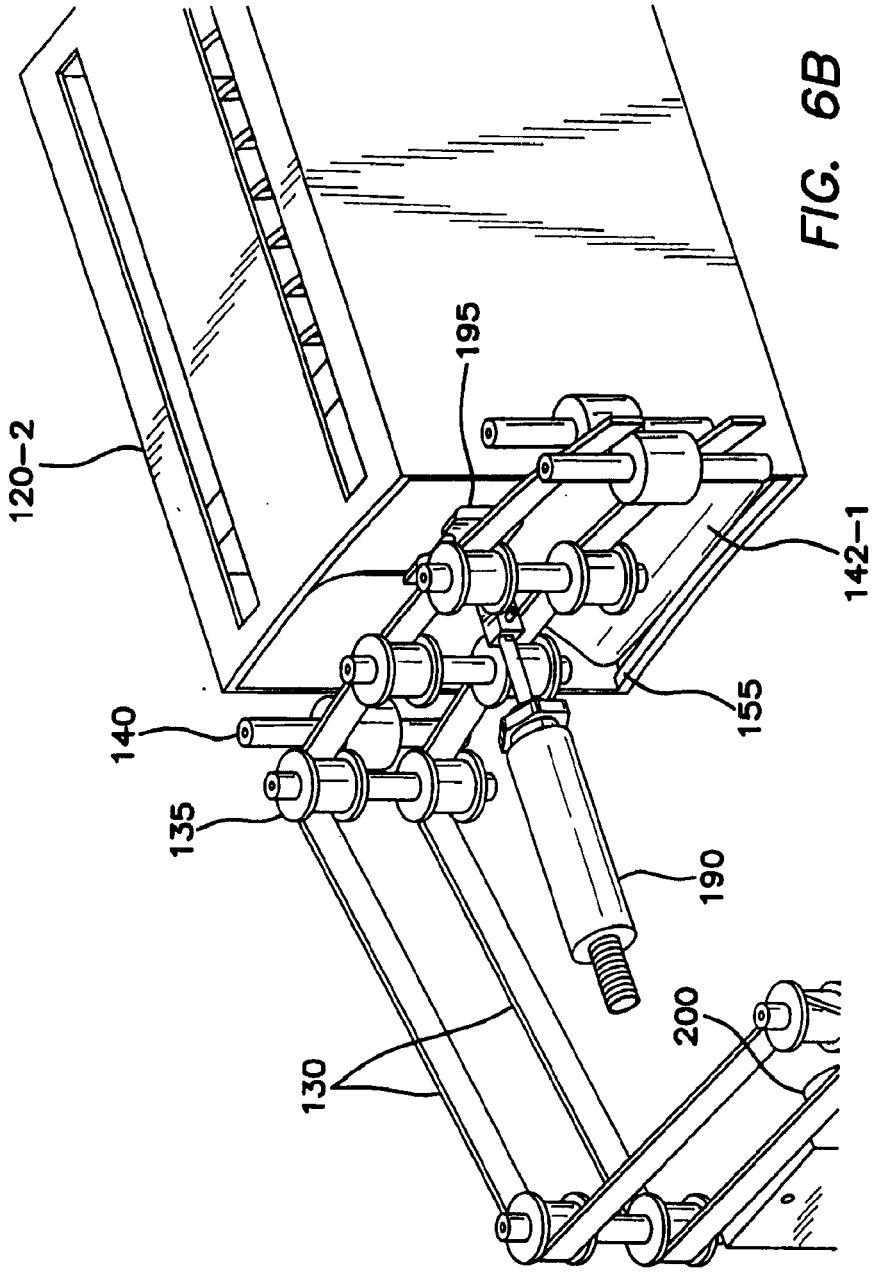


FIG. 6B

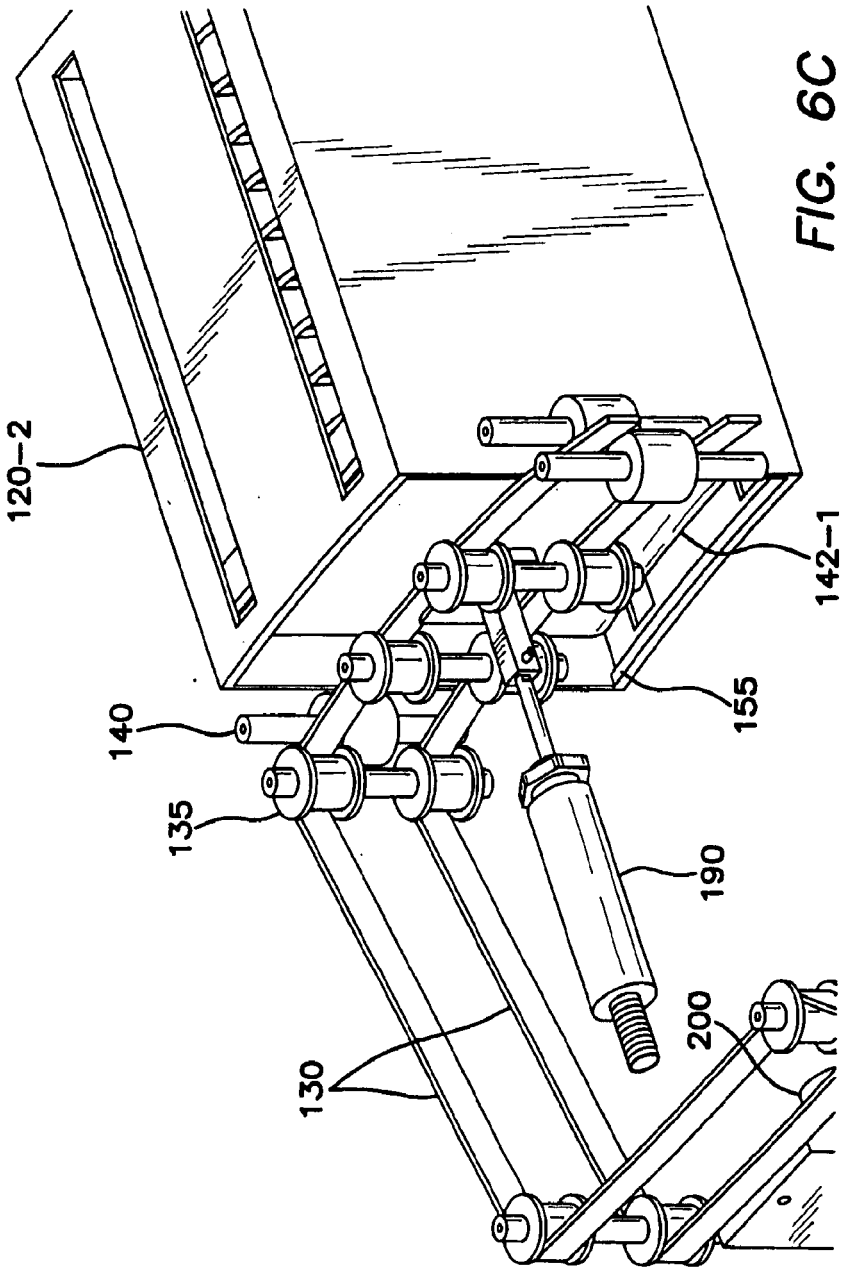


FIG. 6C

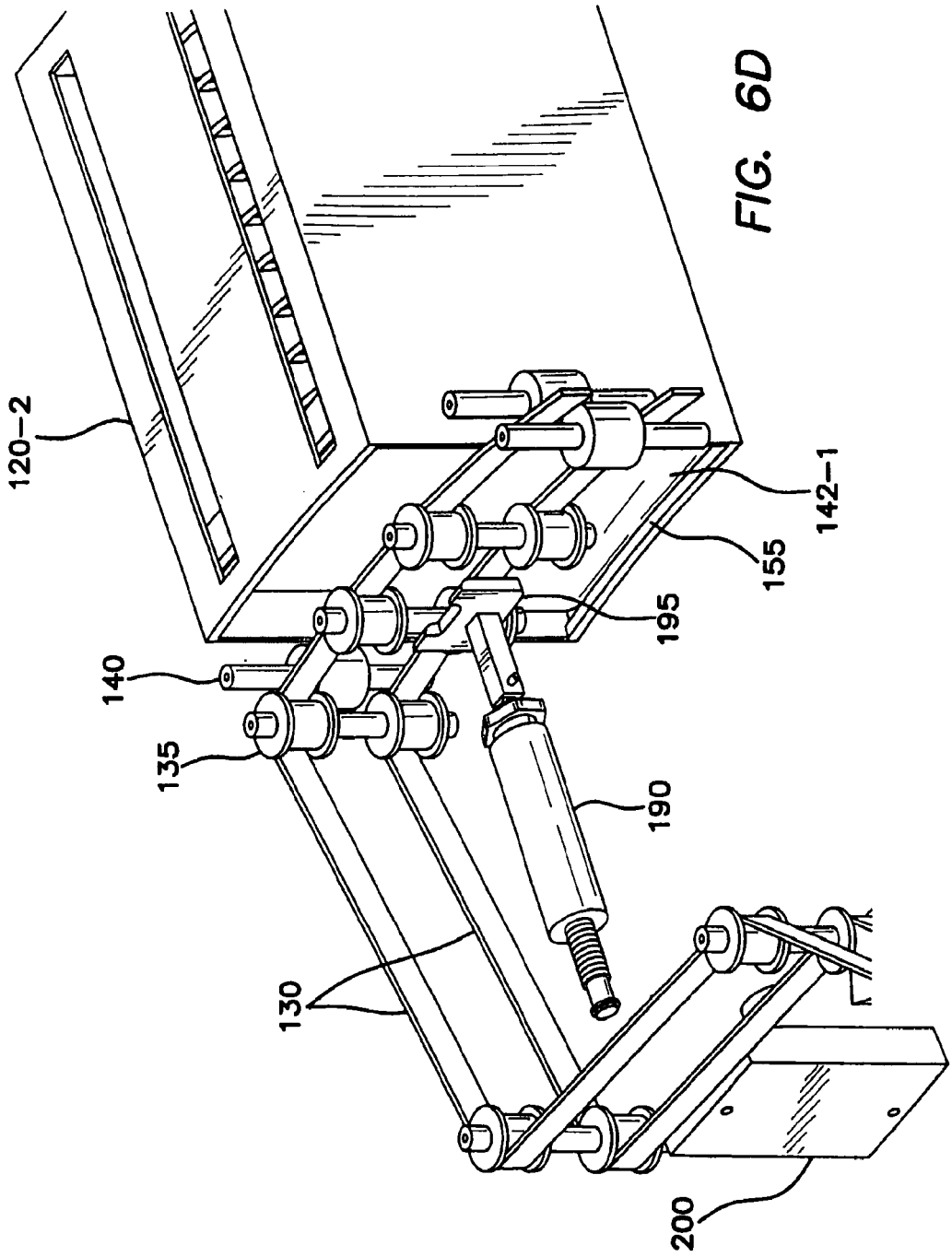


FIG. 6D

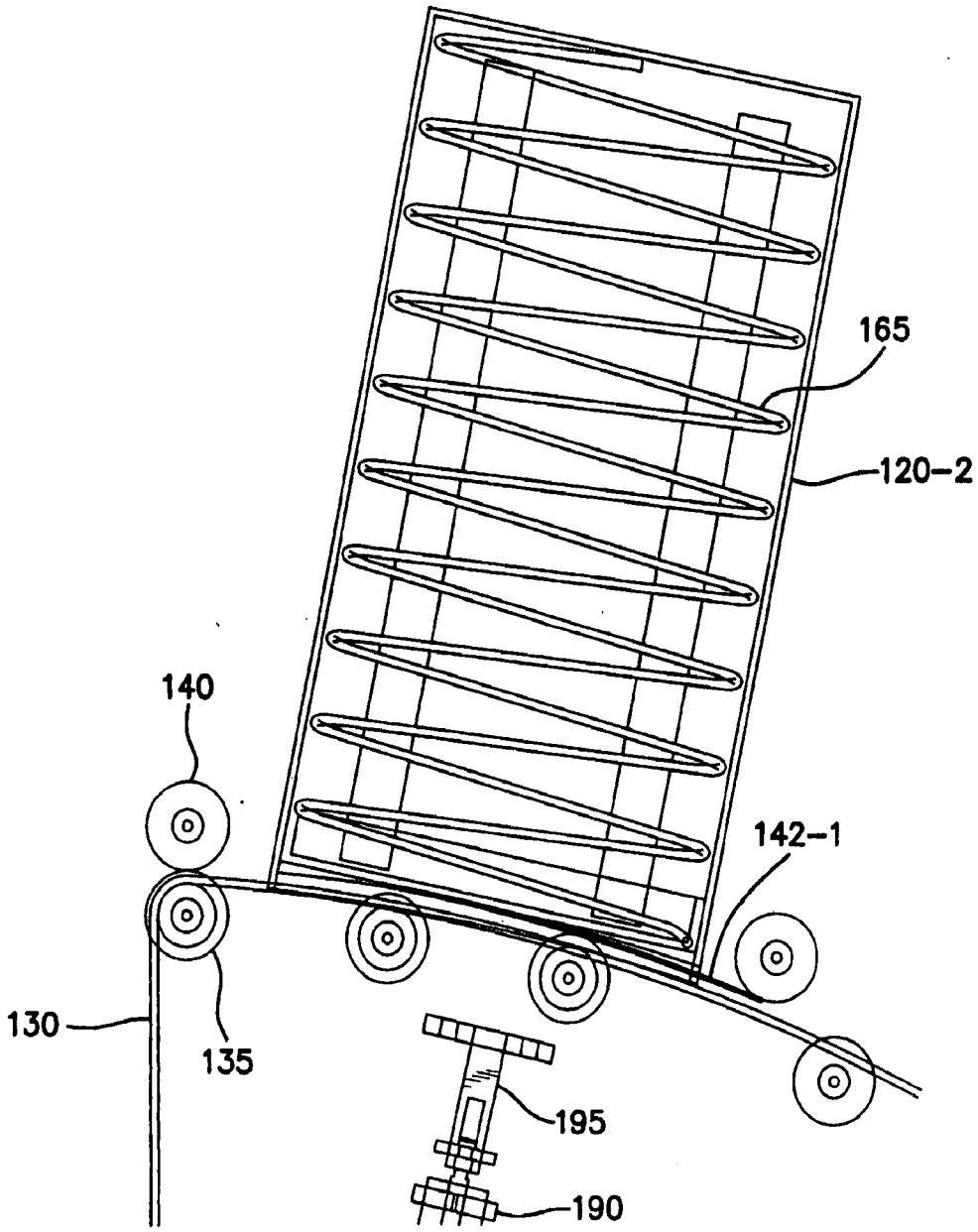


FIG. 6E

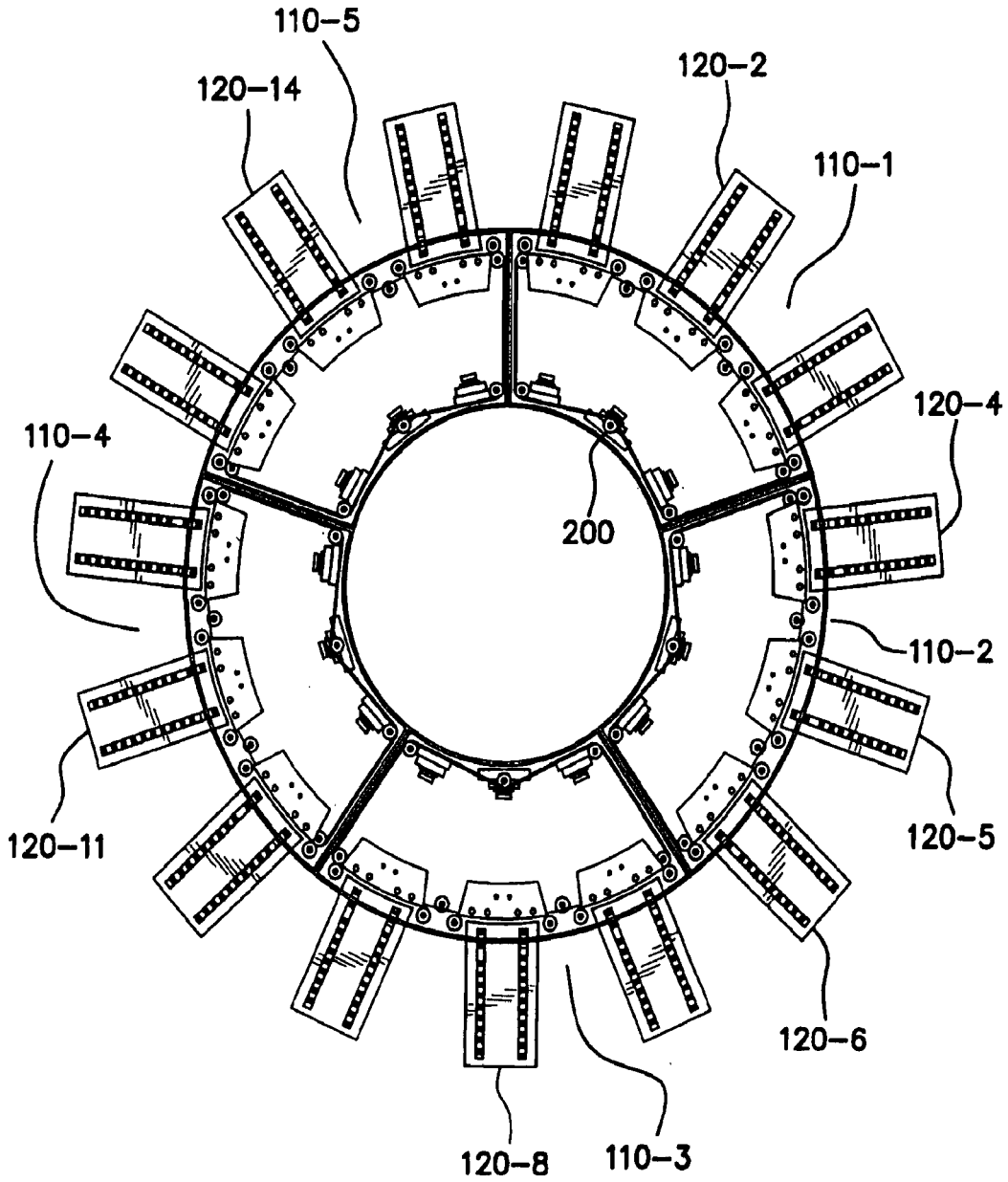

110–5
120–14
120–2
110–1
120–4
110–4
200
110–2
120–11
120–5
120–6
120–8
110–3

FIG. 7

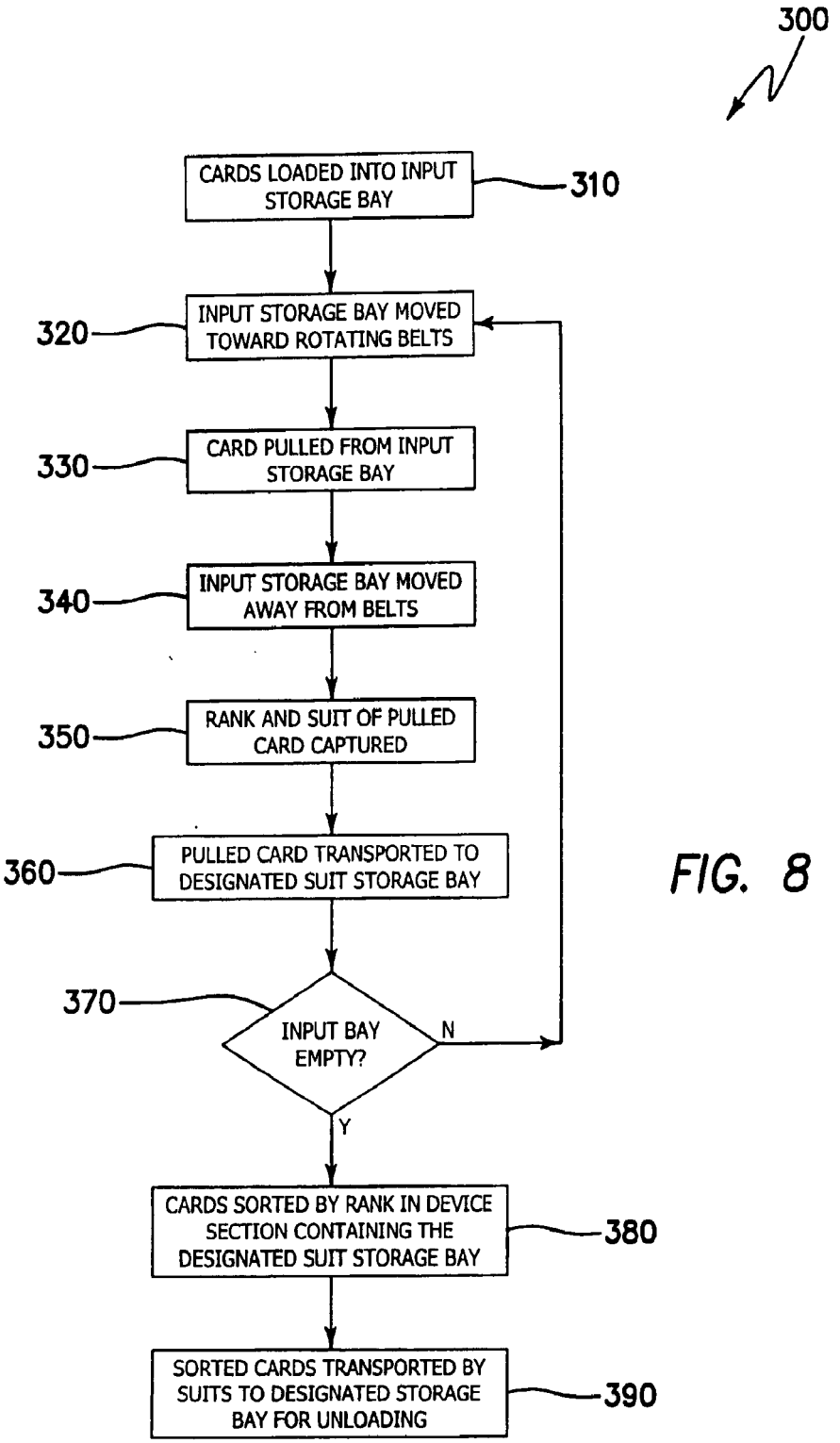

300
CARDS LOADED INTO INPUT STORAGE BAY
310
INPUT STORAGE BAY MOVED TOWARD ROTATING BELTS
320
CARD PULLED FROM INPUT STORAGE BAY
330
INPUT STORAGE BAY MOVED AWAY FROM BELTS
340
RANK AND SUIT OF PULLED CARD CAPTURED
350
PULLED CARD TRANSPORTED TO DESIGNATED SUIT STORAGE BAY
360
370
INPUT BAY EMPTY?
N
Y
CARDS SORTED BY RANK IN DEVICE SECTION CONTAINING THE DESIGNATED SUIT STORAGE BAY
380
SORTED CARDS TRANSPORTED BY SUITS TO DESIGNATED STORAGE BAY FOR UNLOADING
390

FIG. 8