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Playing card shuffler

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A card shuffler apparatus, comprising:
a horizontal card support surface configured to receive cards;
a positioner configured to move a group of cards oriented substantially perpendicular to the card support surface in a first direction and a second opposite direction, the first and second directions substantially parallel to the card support surface, the positioner configured to move to a plurality of positions relative to the card support surface; and
a card receiver configured to receive a single card from the card support surface after the positioner moves the group of cards to a position of the plurality of positions relative to the card support surface.

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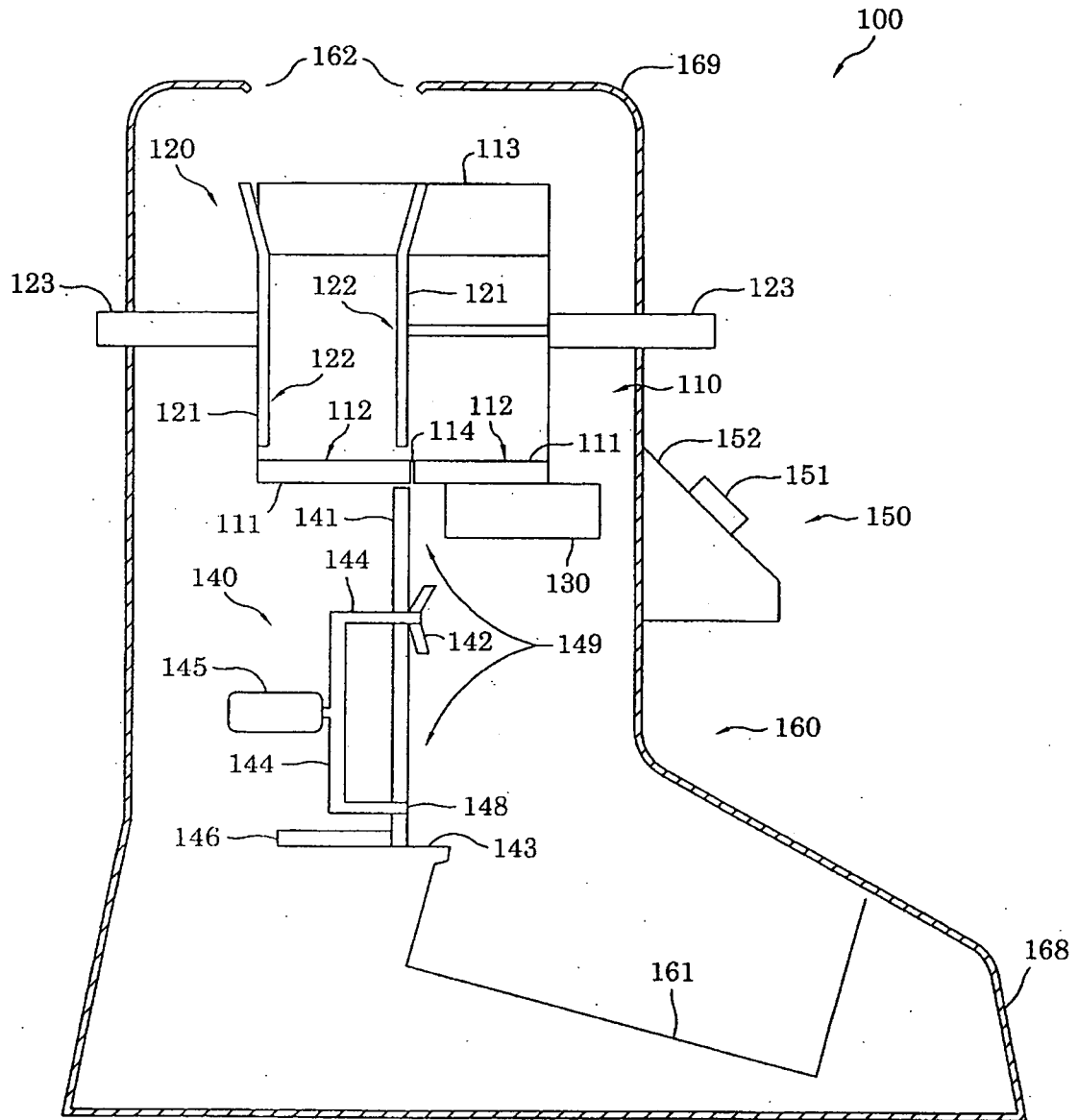


Fig. 1

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SPECIFICATION

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TECHNICAL FIELD

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[0001] The technical field of this invention is shuffling machines for shuffling playing cards used in gaming.

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BACKGROUND INFORMATION

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[0002] Shuffling machines, or shufflers, are widely used in casinos, card rooms and many other venues at which card games are played. Conventional shufflers are typically adapted to receive one or more decks of standard playing cards to be shuffled. The intended purpose of most shufflers is to shuffle the playing cards into what is believed to be a random order. Such a random order of the playing cards is desirable when playing various types of card games such as blackjack, poker and the like. However, in reality most shufflers have tendencies to shuffle or reorder the deck or decks in a manner which skilled card counters can perceive and use to their advantage versus the casino, house or other player. Thus, there is still a need for automated shufflers that function in a manner which more truly randomizes the ordering of a deck or decks of playing cards.

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[0003] Other problems associated with at least some conventional shufflers 20
include excessive size, excessive weight, excessive mechanical complexity and/or 21
electronic complexity. These complexities also may fail to achieve a suitable 22
degree of shuffling, reordering or recompiling into a truly random order from one 23
shuffling process to another. Accordingly, there is still a need for improved 24
automated shuffling machines for playing cards that produce reordering of card 25
decks in a manner which is closer to true randomness and which is more difficult 26
for skilled card players to decipher to change the odds so as to be relatively 27
favorable to the player versus unfavorable portions of a deck or decks of cards. 28

[0004] One casino game commonly called blackjack or 21 is known to be 29
susceptible to card counting and casinos are routinely spending significant 30
amounts of money trying to prevent card counters from taking advantage of non- 31
random sequences in the decks held within a dealing shoe that holds the decks 32
being dealt. Poker has also grown in popularity and is played with a single deck 33
which makes any knowledge of cards of potential significance to a player. 34

[0005] The inventions shown and described herein may be used to address 35
one or more of such problems or other problems not set out herein and/or which 36
are only understood or appreciated at a later time. The future may also bring to 37
light currently unknown or unrecognized benefits which may be appreciated or 38
more fully appreciated in association with the inventions shown and 39

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described herein. The desires and expected benefits explained herein are not 40
admissions that others have recognized such prior needs since invention and 41
discovery are both inventive under the law and may relate to the inventions 42
described herein. 43

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BRIEF DESCRIPTION OF THE DRAWINGS	44
[0006] Preferred forms, configurations, embodiments and/or diagrams	45
relating to and helping to describe preferred aspects and versions of the inventions	46
are explained and characterized herein, often with reference to the accompanying	47
drawings. The drawings and all features shown therein also serve as part of the	48
disclosure of the inventions of the current document, whether described in text or	49
merely by graphical disclosure alone. Such drawings are briefly described below.	50
[0007] Fig. 1 is a diagrammatic elevational view of an apparatus according	51
to at least one embodiment of the inventions.	52
[0008] Fig. 2 is a diagrammatic view of a control system according to at	53
least one embodiment of the inventions.	54
[0009] Fig. 3 is a flow diagram depicting an operational sequence according	55
to at least one embodiment of the inventions.	56
[0010] Fig. 4 is a side diagrammatic elevational view depicting one of a	57
series of operational steps of an apparatus according to at least one embodiment	58
of the inventions.	59
[0011] Fig. 5 is a side diagrammatic elevational view depicting one of a	60
series of operational steps of an apparatus according to at least one embodiment	61
of the inventions.	62

- [0012] Fig. 6 is a side diagrammatic elevational view depicting one of a series of operational steps of an apparatus according to at least one embodiment of the inventions.
- [0013] Fig. 7 is a side diagrammatic elevational view depicting one of a series of operational steps of an apparatus according to at least one embodiment of the inventions.
- [0014] Fig. 8 is a side diagrammatic elevational view depicting one of a series of operational steps of an apparatus according to at least one embodiment of the inventions.
- [0015] Fig. 9 is a side diagrammatic elevational view depicting one of a series of operational steps of an apparatus according to at least one embodiment of the inventions.
- [0016] Fig. 10 is a side diagrammatic elevational view of an apparatus according to at least one alternative embodiment of the inventions.
- [0017] Fig. 11 is a side diagrammatic elevational view of an alternative means for biasing a card array.
- [0018] Fig. 12 is a side diagrammatic elevational view of the mechanism of Fig. 11 with playing cards shown.
- [0019] Fig. 13 is a side diagrammatic elevational view of a further alternative mechanism for biasing the array of playing cards.

- [0020] Fig. 14 is a side diagrammatic elevational view similar to Fig. 13 83
with an array of playing cards therein. 84
- [0021] Fig. 15 is a diagrammatic elevational view showing another 85
alternative construction for intermittently supporting the array of playing cards. 86
- [0022] Fig. 16 is a top view of the subject matter shown in Fig. 15. 87
- [0023] Fig. 17 is a diagrammatic elevational view of a still further version 88
of the invention. 89
- [0024] Fig. 18 is a diagrammatic elevational view of another version of the 90
invention. 91

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DETAILED DESCRIPTION 92

[0025] A table of sections of this detailed description follows. 93

TABLE OF DETAILED DESCRIPTION SUBSECTIONS

INTRODUCTORY NOTES

GENERAL OVERVIEW

CARD SUPPORTS

CARD AND REST POSITIONER

EXCITER

CARD RECEIVER

CONTROLLER

HOUSING

ALTERNATIVE SUPPORT BIASING OF UNSHUFFLED CARD ARRAY

ALTERNATIVE EMBODIMENT - GATED UNSHUFFLED ARRAY GATED SUPPORT

OPERATION

ALTERNATIVE ASPECTS AND CONFIGURATIONS

METHODS AND MANNERS OF USE

MANNER AND MATERIALS OF MAKING

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INTRODUCTORY NOTES 135

[0026] The readers of this document should understand that the 136
embodiments described herein may rely on terminology used in any section of this 137
document and other terms readily apparent from the drawings and the language 138
common therefor as may be known in a particular art and such as known or 139
indicated and provided by dictionaries. Dictionaries were used in the preparation 140
of this document. Widely known and used in the preparation hereof are Webster's 141
Third New International Dictionary (© 1993), The Oxford English Dictionary 142
(Second Edition, © 1989), and The New Century Dictionary (© 2001-2005), all 143
of which are hereby incorporated by reference for interpretation of terms used 144
herein and for application and use of words defined in such references to more 145
adequately or aptly describe various features, aspects and concepts shown or 146
otherwise described herein using more appropriate words having meanings 147
applicable to such features, aspects and concepts. 148

[0027] This document is premised upon using one or more terms with one 149
embodiment that may also apply to other embodiments for similar structures, 150
functions, features and aspects of the inventions. Wording used in the claims is 151
also descriptive of the inventions, and the text and meaning of the claims and 152
abstract are hereby incorporated by reference into the description in their entirety 153
as originally filed. Terminology used with one, some or all embodiments may be 154

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used for describing and defining the technology and exclusive rights associated 155
herewith. 156

[0028] The readers of this document should further understand that the 157
embodiments described herein may rely on terminology and features used in any 158
suitable section or embodiment shown in this document and other terms readily 159
apparent from the drawings and language common or proper therefor. This 160
document is premised upon using one or more terms or features shown in one 161
embodiment that may also apply to or be combined with other embodiments for 162
similar structures, functions, features and aspects of the inventions and provide 163
additional embodiments of the inventions. 164

GENERAL OVERVIEW 165

[0029] Fig. 1 shows one preferred playing card shuffler apparatus 100 167
according to the inventions. The shuffler apparatus is adapted to shuffle a 168
plurality of playing cards, which have been omitted from Fig. 1 for clarity. The 169
apparatus is made up of several subassemblies or subsystems. As shown in Fig. 1, 170
the sections include an entry section wherein cards are placed into the shuffler, a 171
staging section where unshuffled cards are held, a controlled drop section through 172
which cards that are positioned on-edge drop in a fashion preferably facilitated by 173
vibratory action, an intermediate or medial section through which any guiding or 174

directing of dropped cards are affected in their movement toward a collection 175
section wherein the dropped cards are collected and recompiled, and an egress 176
section from which the recompiled or shuffled cards are withdrawn for use in 177
playing the card game or games of interest. 178

[0030] Shuffler 100 includes at least one card support or supporters 110, a 179
repositioner 120, an exciter 130, a receiver 140, a controller 150, and a 180
housing 160. An overview of each of these components is provided immediately 181
below, followed by a more detailed individual description further below. 182

[0031] Still referring to Fig. 1, the supporter 110 functions to support the 183
cards that are to be shuffled. More specifically, the supporter supports the cards 184
in a position substantially above the receiver 140. The repositioner 120 functions 185
to reposition the supported cards relative to the receiver 140. The exciter 130 is 186
configured to impart vibration to the supported cards. The receiver 140 is adapted 187
to receive one or more cards dropped from the supporter. Preferably, the receiver 188
140 is advantageously configured to receive only one card at a time from the 189
supporter. The controller 150 functions to control various operational aspects of 190
the apparatus 100. The housing 160 can have one or more functions including, 191
but not limited to, that of a chassis or frame to support one or more of the other 192
components of the apparatus. 193

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[0032] During a typical use of the apparatus 100, at least one deck of playing cards can be placed into the housing so as to rest on the supporter 110 in a preferably upstanding orientation. The repositioner 120 is activated to move the supported cards to a first randomly selected position above the receiver 140. The exciter 130 is activated to produce a mechanical vibration. This vibration is of a frequency and amplitude sufficient to cause playing cards to dance, or otherwise vibrate, on the supporter 110. For example, the vibration can give the cards an appearance of floating just above the support or the vibration may be almost or totally unperceivable by the naked eye.

[0033] One of the playing cards that is positioned substantially directly above the receiver 140 will preferably drop down into the receiver during operation of the apparatus 100. When a card has dropped into the receiver, the receiver is blocked so that no other cards can enter the receiver. After the first card has dropped into, and is held within, the receiver 140, the repositioner 120 shifts or moves the supported cards to a second randomly selected position above the receiver. After the supported cards are repositioned, the receiver 140 is controlled to release the first card. For example, the receiver can be configured to help guide the card into a card collector 161. Releasing the first card from the receiver 140 unblocks the receiver. More specifically, when the first card is released from the receiver, the receiver is now able to receive a second card.

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[0034] Accordingly, a second card drops into the receiver 140 from the supporter 110. The second card is held in the receiver so that the receiver is now blocked again, preventing any other cards from entering the receiver. After the second card drops into the receiver 140, the repositioner 120 is again activated to move or shift the supported cards to a third randomly selected position substantially above the receiver. The second card is then released from the receiver, thus allowing a third card to drop into the receiver from the support. The second card is preferably placed onto the first card to begin forming a recompiled or shuffled array or stack of cards 20 (See Fig. 9). The third card is likewise preferably stacked on top of the second card. This operation can be continued as desired to randomly reorder the deck or decks of cards. In practice, the apparatus can be configured to repetitively perform steps of the operation very quickly.

CARD SUPPORTS

[0035] As mentioned above with reference to Fig. 1, the apparatus 100 includes a card support 110. The card support preferably includes a card rest 111. The card rest 111 is adapted to support the cards to be shuffled in an orientation which is on-edge. The card support 110 can include a support surface 112. The support surface 112 is preferably defined on the rest 111. Playing cards that are

to be shuffled can contact the support surface 112 while being supported on the 234
card support 110. More specifically, the cards to be shuffled can be supported on 235
the support surface 112. The support surface 112 is preferably substantially flat 236
and/or straight as depicted. The apparatus 100 can be configured such that the 237
support surface 112 is in a substantially horizontal orientation during normal 238
operation of the apparatus 100. 239

[0036] The card support 110 can include one or more edge guides 113. 240
Preferably, the card support includes a pair of edge guides, between which the 241
cards to be shuffled are positioned and advantageously supported such as at the 242
ends laterally. The card support is preferably configured to support the cards in 243
a substantially upstanding orientation. More specifically, the card support 110 is 244
preferably configured to support playing cards on-edge. According to the 245
preferred embodiment of the inventions, cards to be shuffled are supported in an 246
orientation substantially normal to the support surface and substantially normal to 247
the one or more edge guides 113. It is to be understood, however, that the 248
descriptions and depictions provided herein are not intended to limit the shape 249
and/or orientation of one or more components of the card support 110. For 250
example, it should be understood that the support rest surface 112 need not be 251
substantially flat, and that the support rest surface need not be substantially 252
horizontal. The face and end lateral support may also vary in shape and 253

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orientation. The bottom or rest support surface 112 can have at least one of a 254
number of possible shapes, contours and/or orientations. 255

[0037] One or more components of the card support 110 can be designed 256
and/or configured to have at least one resonant frequency, or a range of resonant 257
frequencies. The resonant frequency can be selected to desirably affect imparting 258
vibratory action to the cards supported by the card supports. For example, a 259
resonant frequency can be selected to enhance vibration that is produced by the 260
exciter 130, and which is imparted to the playing cards, such as via rest 111. 261

[0038] With continued reference to Fig. 1, one or more card apertures 114 262
is or are preferably defined in the card rest 111 as depicted. The aperture 263
preferably passes through the support surface 112. The card aperture can be 264
configured substantially in the manner of a slot through which at least one playing 265
card can pass. Preferably, the card aperture 114 is configured to allow passage 266
of only one card at a time. More specifically, the width of the card aperture is 267
greater than the thickness of a single playing card, but less than twice the 268
thickness of a single playing card. Aperture 114 as shown is preferably 269
substantially straight. The aperture 114 has a width that is preferably substantially 270
constant along its length. 271

[0039] The card drop aperture or apertures in the rest 111 can be configured 272
in a manner wherein the aperture is selectively operable. Such aperture or 273

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apertures may be configured to be selectively opened and closed or blocked and 274
unblocked according to at least one embodiment of the inventions. For example, 275
the rest can be made up of two portions. The two portions of the rest can be made 276
to move together to substantially close or block the card drop aperture or 277
apertures. 278

[0040] Conversely, two portions of the card support rest can be made to 279
move away from each other to form a card drop aperture or apertures. 280
Alternatively, one or more gate elements such as described below can be included. 281
Such a gate element or elements can be adapted to move relative to the rest so as 282
to selectively close or block the card drop aperture. 283

[0041] Preferably, the card rest 111 is adapted to support playing cards until 284
the cards are released through one or more apertures 114. In accordance with at 285
least one preferred embodiment of the inventions, the card rest is adapted to 286
support playing cards on-edge. For example, the card rest 111 can be adapted to 287
support playing cards in a substantially upright or upstanding orientation. It is to 288
be understood that when playing cards are supported on-edge by the card rest 111, 289
the cards need not be truly vertical. For example, in accordance with at least one 290
embodiment of the inventions, the card rest 111 is adapted to support playing 291
cards on-edge, wherein the cards are not truly vertical. For example, the card rest 292
can be adapted to support playing cards on-edge in a oblique or leaning, 293

non-vertical, or acceptably tilted orientation which can vary dependent upon the 294
specific construction of each shuffling machine. 295

[0042] The card rest 111 is preferably adapted to selectively impart a 296
vibratory action to playing cards supported on the card rest. In accordance with 297
a preferred embodiment of the inventions, the card rest 111 is adapted to 298
selectively impart a vibratory action to playing cards while the cards are supported 299
on-edge by the card rest. For example, the card rest 111 can be caused to vibrate, 300
which in turn, can impart a vibratory action to playing cards supported thereon. 301
Vibratory action can preferably be imparted to the card rest 111 by the exciter 302
130, which is described in greater detail below. 303

[0043] The preferred vibratory action imparted to playing cards by the card 304
rest 111 may cause the cards to have an appearance of dancing or floating on the 305
card rest 111 and/or support surface 112. The vibratory action is operable at a 306
range of frequencies, such as in the order of 10-100,000 Hz, more preferably 100- 307
10,000 Hz, even more preferably 1000-10,000 Hz. The amplitude may be of 308
varying amounts depending upon the dynamics of the rest and how it is mounted. 309

[0044] The vibratory action of the card rest can have at least one of a 310
number of possible types of motions or movements. For example, the card rest 311
111 can be caused to vibrate with a substantially random motion. Alternatively, 312
for example, the card rest can be caused to vibrate with a substantially defined or 313

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substantially repetitive motion. Vibratory motion of the card rest 111 can be of 314
different types, such as substantially two-dimensional in nature. Alternatively, 315
vibratory motion of the card rest 111 can be substantially three-dimensional. 316

CARD AND REST POSITIONER 317

[0045] Fig. 1 also indicates the positioner 120 is shown as a component of 318
the apparatus 100. The positioner functions to reposition or move in a relative 319
manner the relative position of the array or upstanding playing cards relative to 320
and supported by the card support 110. Preferably, the positioner 120 is adapted 321
to reposition or move playing cards supported on the rest 111. More preferably, 322
the positioner 120 is configured to reposition or move playing cards supported on 323
the support surface 112. The positioner is preferably adapted to reposition or 324
move supported playing cards relative to the receiver 140, which is described in 325
greater detail hereinbelow. Preferably, the positioner 120 is adapted to move or 326
reposition supported playing cards relative to the aperture or slot 114. 327
328

[0046] The positioner 120 can include one or more positioner guides or face 329
guides 121. The face guide 121 is adapted to contact a face of playing cards 330
supported on the support 110. More specifically, the face guide 121 is adapted 331
to contact and/or engage a top side and/or bottom side or face of playing cards 332
supported on the support 110. According to the exemplary embodiment of the 333

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invention, the face guide 121 is substantially parallel to playing cards supported 334
on the support 110. Preferably, the face guide 121 is substantially perpendicular 335
or normal to the edge guide 113. The face guide 121 is preferably substantially 336
perpendicular to the support surface 112. The face guide 121 can be substantially 337
in the form of a flat plate in one form of the inventions. 338

[0047] The face guide defines a contact surface or face 122. The face 122 339
is preferably substantially flat. The face 122 is adapted to contact a flat side of 340
playing cards supported on the support 110. More specifically, the face 122 is 341
adapted to contact and/or engage a top side and/or bottom side or face of playing 342
cards supported on the support 110. According to the exemplary embodiment of 343
the invention, the face 122 is substantially parallel to playing cards supported on 344
the support 110. The face 122 is substantially perpendicular or normal to the edge 345
guide 113 as depicted. As shown, the face guide 122 is substantially 346
perpendicular to the support surface. 347

[0048] The positioner 120 can include a pair of face guides 121. The pair 348
of face guides 121 is preferably maintained in juxtaposed orientation relative to 349
each other. More preferably, the pair of guides 121 is preferably maintained in 350
a substantially parallel juxtaposed orientation, as shown. The pair of face guides 351
121 are preferably maintained in a spaced apart relationship. More specifically, 352
each of the pair of guides 121 is preferably located on opposing sides of playing 353

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cards supported on the rest 111. For example, supported playing cards are 354
preferably located between the pair of repositioning guides 121. 355

[0049] The spacing between the pair of guides is preferably variable. Such 356
variable spacing between the guides can facilitate keeping supported cards in an 357
upstanding orientation as the number of supported cards changes. For example, 358
as the apparatus 100 shuffles playing cards, the number of playing cards supported 359
on the rest 111 will decrease. Thus, as the number of supported playing cards 360
decreases, the repositioning guides may in controlled response, move closer to 361
each other to compensate for the decrease in the number of supported cards. 362

[0050] The positioner 120 can include at least one actuator 123. The 363
actuator is preferably adapted to actuate or move at least one positioner guide 121. 364
According to a preferred embodiment of the inventions, the actuator 123 is 365
connected or linked to at least one face guide 121. For example, the positioner 366
actuator 123 can be a linear actuator as depicted. Preferably, the positioner 367
includes a pair of actuators 123 as shown. More preferably, the positioner 368
includes a pair of face guides 121 and a pair of actuators 123, wherein each 369
actuator is exclusively associated with one of the face guides, as depicted. More 370
specifically, each of the face guides is individually movable or repositionable 371
according to the preferred embodiment of the inventions. Most preferably, each 372

of the face guides 121 is individually movable or repositionable by way of an 373
associated actuator 123. 374

[0051] According to the preferred embodiment of the inventions, the 375
positioner guides 121 are adapted to reposition supported playing cards by pushing 376
and/or sliding the cards along the rest 111 and/or the support surface 112. Such 377
repositioning of supported cards is preferably performed while vibratory action is 378
imparted to the cards by the exciter 130, which is described in greater detail 379
below. The positioner guides 121 are adapted to reposition or move supported 380
playing cards as well as being adapted to move relative to each other. By moving 381
relative to each other, the guides 121 are able to vary the spacing between them 382
to account for varying numbers of supported cards. 383

EXCITER 384

[0052] With continued reference to Fig. 1, the apparatus 100 includes at 385
least one exciter 130. The exciter is adapted to impart vibratory action in playing 386
cards supported by the card support 110. Preferably, the exciter is adapted to 387
impart vibratory action to playing cards supported by the card rest 111. More 388
preferably, the exciter is configured to impart vibratory action to playing cards 389
supported on the support surface 112. In accordance with at least one embodiment 390
of the inventions, the exciter 130 is adapted to impart vibratory action to the card 391
392

rest 111. For example, imparting vibratory action to the card rest 111 can be 393
accomplished in a manner wherein vibratory action is, in turn, imparted from the 394
card rest 111 to playing cards supported thereon. Thus, according to at least one 395
embodiment of the inventions, the exciter 130 is adapted to impart vibratory action 396
to playing cards by imparting vibratory action to the card rest 111, which in turn 397
imparts vibratory action to cards supported thereon. 398

[0053] The exciter 130 is preferably adapted to create a mechanical 399
vibration. The vibration created by the exciter can be at least one of a number of 400
possible types of vibration. For example, the vibration created by the exciter 130 401
can be substantially two-dimensional in nature. Alternatively, the vibration 402
created by the exciter 130 can be substantially three-dimensional in nature. As a 403
further example, the vibration created by the exciter 130 can consist of 404
substantially random vibratory motion. Alternatively, vibratory motion of the 405
exciter can be substantially regular and/or repetitive in nature. The vibratory 406
action created by the exciter can be of a relatively high-frequency. The vibratory 407
action created by the exciter may be of a relatively low-amplitude. Preferably, the 408
vibratory action created by the exciter 130 is of substantially high frequency and 409
low amplitude. More preferably, the vibratory action created by the exciter is of 410
a frequency and/or amplitude that causes supported cards to behave in a manner 411
that is advantageous to the operation of the apparatus 100 as described herein. 412

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[0054] The exciter 130 is preferably connected to the card support 110. For 413
example, the exciter can be connected and/or linked with the card rest 111, as 414
shown. The exciter is preferably connected with at least a portion of the card 415
support 110 so as to impart vibratory action from the exciter to playing cards 416
supported on the support 110. According to the exemplary embodiment of the 417
inventions, the exciter 130 is connected to and/or mounted directly on the card 418
support 110. For example, the exciter can be connected to and/or mounted 419
directly on the card rest 111, as shown. According to an alternative embodiment 420
of the inventions, the exciter 130 is substantially integrated with the card 421
support 110. 422

[0055] The exciter 130 can be configured to operate according to at least 423
one of various possible manners of creating vibratory action, both known and yet 424
to be discovered. Such manners of creating vibratory action can include, for 425
example, mechanical means, electrical means, and electro-mechanical means, 426
among others. For example, one way of creating vibratory action is by employing 427
a rotary actuator (not shown) such as a rotary motor to rotate a weight that is 428
eccentrically positioned relative to its axis of rotation. Another example of 429
creating vibratory action is to subject a movable ferric object (not shown) to an 430
electro-magnetic field of dynamically alternating polarity to cause the ferric object 431
to oscillate or vibrate. In accordance with at least one embodiment of the 432

inventions, the frequency and/or the amplitude of the vibratory action created by the exciter 130 is selectively adjustable.

CARD RECEIVER

[0056] Still referring to Fig. 1, the card receiver 140 is included in the apparatus 100. The card receiver is adapted to receive at least one playing card from the card support 110. Preferably, the card receiver 140 is adapted to receive only one playing card at a time. For example, the card receiver 140 can be sized and/or otherwise configured so that no more than one playing card at a time can be received into the card receiver. The receiver 140 includes a slot or space into which one or more playing cards are received from the card support 110. The card space 149 of the receiver can have one of a number of possible specific configurations. The receiver 140 is adapted to receive and hold one or more playing cards in the card space 149. In some embodiments, the receiver 149 is adapted to selectively retain one or more received playing cards within the card space 149.

[0057] The receiver 140 can include a card stop 143. The card stop 143 preferably defines at least a portion of the card space 149 and is within the intermediate or medial section. The handling of the dropped card or cards in the medial section can have a number of different configurations. For example, the

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card stop 143 can define a lower end of the card drop space 149. Placement or 453
location of the card stop 143 relative to the support surface 112 can be of 454
significance to the operation of the apparatus 100. Specifically, the card stop is 455
preferably located to be a certain distance from the support surface 112, wherein 456
the distance is substantially equal to either a length or a width of playing cards 457
being shuffled. More preferably, when a playing card has been received into the 458
receiver 140 from the support 110, an upper edge of the received playing card is 459
substantially even, or flush, with the support surface 112. The significance of this 460
aspect of the inventions becomes clearer in view of later description with respect 461
to the operation of the apparatus 100. 462

[0058] The receiver 140 can include one or more guides. For example, the 463
receiver can include a first guide portion 141 and a second guide portion 142. 464
The receiver guides or guide portions 141, 142 can define at least part of the card 465
space or card slot 149 into which a playing card is received from the support. 466
Preferably, the card space 149 is substantially straight as depicted. The card space 467
149 is preferably substantially vertical in orientation, as is also depicted. The card 468
space is preferably substantially directly below the card aperture 114. According 469
to the exemplary embodiment of the invention depicted in Fig. 1, a playing card 470
is dropped from the support surface 112 through the aperture 114, and is received 471
into the card space 149 between the first guide portion 141 and the second guide 472

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portion 142. The received playing card is preferably supported substantially upon 473
the stop 143 such that a bottom edge of the received card rests upon the stop and 474
an opposite upper edge of the received card is substantially flush or even with the 475
support surface 112. 476

[0059] As shown, receiver 140 preferably includes at least one receiver 477
actuator 145. The receiver actuator can be a linear actuator such as a linear 478
solenoid, for example. The receiver actuator 145 is preferably selectively 479
controlled. The receiver actuator 145 can be adapted for selective control by the 480
controller 150, as is described in greater detail hereinbelow. The receiver 140 can 481
include a link or linkage 144. The link can be connected to the receiver actuator 482
145, as depicted. More specifically, link 144 can be operably connected to the 483
actuator 145 for selective movement of the link. The link can be connected to at 484
least one portion of the receiver guides such as the second guide portion 142, as 485
shown. 486

[0060] The link can include a bottom guide 148. The bottom guide is 487
adapted to contact and/or engage a received playing card that is retained in the 488
card space 149. The actuator 145 along with the link 144 and bottom guide 148 489
can make up and/or form portions of a release mechanism. The second guide 490
portion 142 can be included in such a release mechanism. Specifically, the 491
actuator 145 together with the link 144, bottom guide 148 and second guide 492

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portion can be configured to facilitate release of a playing card retained in the card space 149. For example, according to the exemplary embodiment of the inventions, the actuator 145 can be activated to move the link 144 toward the first guide portion 141.

[0061] Movement of the link 144 toward the first guide portion 141 can cause the second guide portion 142 to move away from the first guide portion 141, while at the same time causing the bottom guide 148 to push a lower end of the retained card away from the first guide portion and past the stop 143. This operation is described hereinbelow in greater detail. Such an operation of the actuator 145 and link 144 in this manner can cause release of a retained playing card from the card space 149. A playing card released from the retained position in the card receiver 140 can cause the card to fall into a collector 161. Following release of a retained playing card, the actuator 145 can be activated to return to the original position shown in Fig. 1. With the second guide portion 142 and bottom guide 148 in their original respective positions, the receiver 140 is ready to receive another playing card from the support 110.

[0062] The receiver 140 can include at least one card sensor 146. The card sensor 146 can be adapted to detect presence of a playing card which has dropped into the medial zone. More specifically, in accordance with the exemplary apparatus depicted in Fig. 1, the sensor 146 can be adapted to detect that a playing

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card is present and/or is retained within the card space 149. Such detection of a 513
playing card retained within the card space can facilitate operation of the 514
apparatus 100. For example, a playing card can be allowed to drop from the 515
support 110 into the card space 149 of the receiver 140. 516

[0063] The sensor 146 is adapted to detect that a playing card is fully 517
received into the medial card space. The sensor 146 can send a signal to the 518
controller 150 in response to detecting that a playing card has been fully dropped 519
onto the stop and received into the card space 149. When the controller receives 520
this signal from the sensor, the controller can, in response, activate the guide or 521
director 120 to reposition playing cards supported by the support 110. 522

[0064] Although not preferred it is also possible that the sensor 146 can be 523
employed to detect the absence of any playing card or cards from the stopped 524
medial position in card space 149. This can be accomplished by configuring the 525
controller 150 to recognize that all cards have been shuffled when the sensor 146 526
or other sensor so indicate presence or absence of playing card in the card space 527
or at other locations not believed preferred at this time. 528

[0065] It is noted that the receiver 140 is depicted as being separate and 529
distinct from the support 110 and/or other components of the apparatus 100. 530
However, it is to be understood that one or more portions of the receiver can be 531
at least substantially integral with one or more portions of the support 110. For 532

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example, in accordance with at least one alternative embodiment of the inventions, 533
the first guide portion 141 is integral and/or connected with the rest 111. 534
Similarly, the aperture 114 can be at least partially integrated with the receiver 140 535
according to at least one embodiment of the inventions. 536

CONTROLLER 537

[0066] With reference now to Figs. 1 and 2, the apparatus 100 can include 539
a controller 150. The controller can be at least a portion of a control system 200, 540
which can include at least one additional component, such as but not limited to, 541
the positioner actuator 123, the exciter 130, the receiver actuator 145, the 542
sensor 146, and the user interface 151. The controller 150 and/or the control 543
system 200 is adapted to perform one or more various control functions in 544
facilitation of operation of the apparatus 100. Examples of various control 545
functions that can be performed by the controller 150 and/or the control system 546
200 are provided further below with respect to description of operation of the 547
apparatus 100. 548

[0067] The controller 150 can be supported on or mounted to the housing 549
160. The controller can be mounted within the housing or on the exterior of the 550
housing. The controller 150 can include a user interface 151. The user interface 551
is preferably configured to facilitate input of operational commands by a user of 552

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the apparatus 100. For example, the user interface 151 can include and/or can be 553
substantially in the form of a switch. Such a switch can be an on/off switch, a 554
stop/start switch, or a power switch for example. The user interface 151 can be 555
adapted for other input commands. For example, the user interface can be adapted 556
to input and/or select optional dimensions or other characteristics of playing cards 557
to be shuffled. Specifically, for example, the user interface 151 can be 558
substantially in the form of a control panel having multiple command input 559
parameters available to a user of the apparatus 100. 560

[0068] In a further alternative version, the need for controls may be 561
eliminated or simplified to a great degree. The shuffler machine may be 562
constructed so as to sense when a card array is input and then merely 563
automatically perform the shuffling process as a result of a sensor that detects 564
cards placed within the input supports. 565

[0069] The controller 150 can include an enclosure 152. The user interface 566
151 can be mounted on, or supported by, the enclosure 152. A processor 153 is 567
preferably included as part of the controller 150. The processor can be a digital 568
processor such as a microprocessor or the like. The processor 153 is preferably 569
contained within the enclosure 152. The controller 150 preferably includes a 570
computer readable memory 154. The computer readable memory is preferably 571
housed within the enclosure 152. The processor 153 and the computer readable 572

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memory 154 are preferably linked for signal transmission. More specifically, the processor is preferably able to read data and/or computer executable instructions 155 from the computer readable memory 154. According to at least one embodiment of the inventions, the processor 153 is able to write or store data in the computer readable memory 154. The controller 150 can include a random number generator 156. The random number generator can be adapted to facilitate generation of random positions of the supported playing cards, as is described in greater detail hereinbelow. The random number generator 156 can be integral with the processor 153 and/or the computer executable instructions 155.

[0070] The controller 150 can be linked for signal transmission to one or more components of the apparatus 100. More specifically, the control system 200 and/or the apparatus 100 can include at least one communication link 159 adapted to facilitate signal transmission between the controller 150 and other components of the apparatus and/or control system. For example, the controller can be linked for signal transmission with one or more of the positioner actuators 123, the exciter 130, the receiver actuator 145 and the sensor 146. The controller 150 can be linked for signal transmission with an optional aperture actuator 119 that is shown in Fig. 2. According to an alternative embodiment of the inventions, the apparatus 100 and/or the control system 200 can include the aperture actuator 119 to selectively open and close (or block and unblock) at least one card aperture 114

(shown in Fig. 1). The controller 150 can include various electrical and/or 593
electronic components that are not shown, such as but not limited to, relays, 594
timers, counters, indicators, switches, sensors and electrical power sources. 595

[0071] The controller 150 is preferably adapted to facilitate operation and/or 596
function of one or more components to which it is linked for signal transmission. 597
For example, the controller 150 can be adapted to send on and off signals to the 598
exciter 130. The controller 150 can be adapted to send control signals to at least 599
one actuator, including, but not limited to one or more positioner actuators 123, 600
receiver actuators 145, and aperture actuators 119 (shown in Fig. 2). For example, 601
the controller 150 is preferably adapted to control positioning and/or activation of 602
one or more actuators. The controller is preferably configured to receive and/or 603
process input commands and/or data from the user interface 151. Preferably, the 604
controller 150 is adapted to receive and/or process signals generated by the sensor 605
146. The controller 150 is preferably adapted to generate and/or determine 606
random positions of the supported cards, and to command the positioner 120 to 607
move the supported cards to the randomly generated positions. 608

HOUSING 610

[0072] With reference to Fig. 1, the apparatus 100 includes at least one 611
housing 160. The housing can function as a chassis or frame for one or more 612

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additional components of the apparatus 100. More specifically, one or more 613
components of the apparatus 100 can be mounted on, or supported by, the housing 614
160. For example, the housing is preferably adapted to support one or more of the 615
card support 110, the positioner 120, the exciter 130, the receiver 140, and the 616
controller 150. The housing 160 can be adapted to function as an enclosure for 617
one or more components of the apparatus 100, wherein the housing is adapted to 618
substantially protect the enclosed components from damage and/or contamination. 619
More specifically, one or more components of the apparatus can be enclosed 620
within the housing 160 to decrease likelihood of damage and/or contamination. 621
For example, the housing is preferably adapted to enclose one or more of the card 622
support 110, the positioner 120, the exciter 130, the receiver 140, and the 623
controller 150. 624

[0073] The housing 160 can include one or more features to facilitate 625
operation and/or use of the apparatus 100. For example, the housing can include 626
a card collector 161. The card collector 161 is preferably adapted to catch and/or 627
collect playing cards released from the receiver 140. The card collector can be 628
configured to form a stack of collected playing cards. For example, the card 629
collector 161 can be sloped or tilted to facilitate collection of playing cards into 630
a substantially orderly stack. According to at least one embodiment of the 631
inventions, the card collector 161 is adapted to vibrate. Such vibration of the card 632

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collector can facilitate collection of playing cards and/or formation of an orderly 633
stack of collected and shuffled playing cards. For example, the exciter 130 can 634
be configured to impart vibratory action to the card collector 161. 635

[0074] The housing 160 can have at least one opening 162. The opening 636
can serve one or more of a number of possible uses or purposes. For example, the 637
opening 162 can be adapted to provide for placing a deck of cards into the card 638
support 110. The housing 160 preferably has at least one other opening (not 639
shown) proximate the card collector 161 to facilitate retrieval of the shuffled cards 640
from the card collector. Still other openings (not shown) in the housing 160 can 641
be provided for one or more of a number of purposes. For example, at least one 642
opening (not shown) can be provided in the housing to facilitate access to one or 643
more components for repair and/or maintenance. 644

[0075] The housing 160 has a lower end 168 and an opposite upper end 169. 645
The lower end 168 preferably includes and/or forms a base for contacting or 646
engaging a support surface such as a tabletop, counter top or shelf (not shown). 647
Preferably, at least one opening 162 is positioned near the upper end 169 as shown 648
to facilitate placement of playing cards into the card support 110. The card 649
support 110 is preferably proximate the upper end 169. The card collector 161 is 650
preferably proximate the lower end 168. The receiver 140 is preferably situated 651
substantially between the card support 110 and the card collector 161, as depicted. 652

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According to at least one preferred embodiment of the inventions, the housing 160 653
is configured so that the support surface 112 is substantially horizontal under 654
normal operating conditions, as shown. 655

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ALTERNATIVE SUPPORT BIASING OF UNSHUFFLED CARD ARRAY 657

[0076] Figs. 11 and 12 show an alternative mechanism for biasing the array 658
of upstanding cards. The card support or support 110 is fitted with one or more 659
gravity biasing mechanisms 301. As shown, mechanism 301 has a pivot 302. A 660
counterbalancing weight 303 is forced downward by gravity to swing the contact 661
arm 306 against the upstanding unshuffled card array 320. 662

[0077] The contact arm 306 is advantageously formed in a convex shape as 663
seen from the array of cards 320. This minimizes any potential wear or marking 664
of the cards. It also applies a relatively light force automatically without precise 665
control of a stepper motor. However, precise control may not be necessary since 666
friction between the cards is minimal and sufficiently low to allow individual 667
cards to drop through the card drop aperture without sufficient impedance such 668
that dropping due to gravity occurs. The vibratory action of the unshuffled card 669
array further reduces any impedance against dropping since the coefficient of 670
friction is typically lower in a dynamic or moving relationship versus the static 671
coefficient of friction. Thus, one advantage of the preferred shufflers is that the 672
vibratory action has the cards effectively floating due to the vibratory excitation 673
of the unshuffled card array. 674

[0078] Figs. 13 and 14 show a further alternative means for biasing the 675
unshuffled card array. The means shown in these figures includes a ball 401. 676

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Ball 401 is positioned on a lateral guide 402 which is sloped toward the unshuffled card input support chamber 403. As illustrated in Fig. 14, ball 401 is biased or forced by gravity to apply a lateral component of force to the unshuffled card array 420. A relatively small amount of force is currently preferred, such as a small ball of light weight. One possible form is a ping-pong ball or other small ball or other shape which can urge the unshuffled card array using gravity, a spring (not shown) or other suitable biasing means which apply a relatively small amount of force to keep the unshuffled card array in a sufficiently upstanding orientation to facilitate dropping through the card drop apertures and into the medial zone of the shuffling machine.

ALTERNATIVE EMBODIMENT - GATED UNSHUFFLED ARRAY GATED SUPPORT

[0079] Figs. 15 and 16 show pertinent features of a further alternative embodiment of shuffling machine 500 according to the inventions hereof. Fig. 15 shows the unshuffled array 530 in phantom. The array is supported alternatively by the rest 512 and movable gates 567 on opposing sides (ends of cards as shown).

[0080] The shuffler 500 has lateral supports 113 that may be provided with flanges 572 which can be constructed to slide within support channels 573. This construction allows the lateral supports to move with the unshuffled deck 530.

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The relative motion may in fact involve motion of the supports and cards, the cards relative to the supports or both the supports and cards to move relative to a fixed reference point and relative to the card drop slot or slots 514.

[0081] Rest 512 is as shown provided with two card drop slots 514 formed in the rest or rests 512. A pair of gate pieces 567 are mounted to slide inwardly and outwardly upon the support deck 512 using actuators (not shown but similar to 123 or suitable alternatives thereof). When the gate pieces are controlled to slide inwardly the rounded corners of the playing cards on the bottom are engaged and supported on the gate pieces thus preventing them from dropping through slots 514. Thus the unshuffled array may be lifted slightly and relative motion between the card array and drop slots is performed and then the gates are opened by moving them outwardly and cards may then drop through the slots 514.

[0082] This construction may be controlled or configured so that the gating action occurs independently for each drop slot relative to the other drop slot. Furthermore, they can be simultaneously dropped and the guiding parts contained in the medial section may appropriately accommodate the recompiling of the cards.

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OPERATION 715

[0083] With reference now to Fig. 3, a flow diagram depicts a sequence of 716
operational steps 300 that can be carried out by one or more components of the 717
apparatus 100 according to at least one embodiment of the inventions. With 718
reference to Figs. 1-3, the sequence 300 moves from a starting point 301 to step 719
303, wherein a plurality of playing cards is placed onto the card support 110. The 720
step of placing the cards into the apparatus according to step 303 can be 721
accomplished by a user of the apparatus. The starting point 301 can include 722
turning the apparatus on, or initializing the apparatus. This can be accomplished 723
by the user. For example, the user can turn the apparatus on or initialize the 724
apparatus by manipulating the user interface 151. 725

[0084] The next step 305 is to command the positioner 120 to grip the 726
supported cards. In accordance with an alternative embodiment of the inventions, 727
an optional aperture actuator 119 (shown in Fig. 2) is commanded to close or 728
block the card aperture 114 (shown in Fig. 1). This step of generating and 729
transmitting command signals can be carried out by the controller 150. From step 730
305, the sequence moves to a step 307 that includes generating a start position of 731
the supported cards relative to the card aperture 114, and commanding the 732
positioner 120 to move the supported cards to the start position. The start position 733
is preferably randomly determined. This step of generating the start position and 734

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commanding the positioner 120 to move the supported cards can be accomplished 735
by the controller 150. 736

[0085] The sequence 300 moves next to a step 309 of activating the exciter 737
130. More specifically, the exciter is turned on or operated so as to impart 738
vibrational action to the supported cards. The step of activating the exciter can 739
be carried out by the controller 150. The step 309 of activating the exciter can 740
have other alternative positions in the sequence 300. For example, the step of 741
activating the exciter can be the first step of the sequence. Once the exciter is 742
turned on, the sequence moves to a step 311 of commanding the positioner 120 743
to release the supported cards. In accordance with an alternative embodiment of 744
the inventions, the optional aperture actuator 119 (shown in Fig. 2) is commanded 745
to open/unblock the card aperture 114 (shown in Fig 1). This step 311 can be 746
performed by the controller 150. From step 311, the sequence 300 moves to step 747
313 during which a counter is initialized to unity. More specifically, for example, 748
a variable "n" is set to a value of "1" according to this step, which can be 749
accomplished by the controller 150. 750

[0086] From the step 313, the operational sequence 300 moves to a query 751
315. The query 315 asks whether the nth card is detected in the receiver 140. 752
More specifically, the query 315 asks whether the nth card has dropped into a 753
fully received position within the card receiver 140. This query 315 can be 754

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performed by the controller 150 in conjunction with the sensor 146. For example, 755
the sensor looks for a card to drop into a fully received position within the card 756
space 149. When the sensor 146 detects the presence of the card, the sensor 757
transmits a signal to the controller 150 by way of the respective communication 758
link 159. The controller receives the signal from the sensor as indication that the 759
nth card has been fully received into the receiver 140. 760

[0087] If the answer to the query 315 is "yes," then the sequence 300 761
proceeds to a step 317, wherein the nth position is randomly generated and the 762
positioner 120 is commanded to move the supported cards to the nth random 763
position. This step 317 can be performed by the controller 150, for example. 764
From this step, the sequence 300 moves to a step 319, in accordance with which 765
the receiver 140 is commanded to release the nth card. For example, the nth card 766
is released from a retained position in the card space 149, and is allowed to drop 767
into the card collector 161. This step of commanding the receiver to release the 768
nth card can be performed by the controller 150, for example. From the step 319, 769
the sequence proceeds to a step 321, wherein the counter is incrementally 770
increased to the next value. Specifically, the value of the variable, "n" is 771
increased by a value of one. 772

[0088] From the step 321, the sequence returns to the query 315 described 773
above. As is described above, if the answer to the query 315 is "yes," then the 774

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steps 317, 318, 319 and 321 are repeated. For example, the steps 317-321 of 775
generating the nth random position for the supported cards, moving the supported 776
cards to the nth random position, releasing the nth card from the card receiver, and 777
incrementing the counter, continue as long as the sensor 146 continues to detect 778
the nth card being fully received into a retained position within the card space 779
149. However, if the answer to the query 315 is "no," then the sequence 300 780
proceeds to end point 323. For example, if the controller 150 does not receive a 781
signal from the sensor 146 for a predetermined period of time (i.e., the sensor fails 782
to detect the presence of a card being fully received into a retained position within 783
the card space 149), then the controller will assume that there are no additional 784
cards to process, and the controller will end the operational sequence. 785

[0089] Referring now to Figs. 4-9, a series of elevational views of the 786
apparatus 100 illustrates an operational sequence according to at least one 787
embodiment of the inventions. With reference to Fig. 4, the apparatus 100 is 788
shown in a card loading mode or status. With the apparatus in the loading mode, 789
the positioner guides 121 are positioned to receive a deck of cards 10 through the 790
loading opening 162. As shown, the plurality of cards 10 to be shuffled has been 791
inserted through the loading opening 162 and has been set on the support 110. 792
More specifically, the plurality of cards 10 to be shuffled has been placed on the 793
support surface 112. According to the exemplary embodiment of the inventions, 794

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when the apparatus is in the loading mode, the cards 10 to be shuffled are not 795
above the card aperture 114. More specifically, when in the loading mode the 796
positioner guides 121 are offset relative to the card aperture 114, as shown, so that 797
the card aperture is not below the supported cards 10. 798

[0090] Still referring to Fig. 4, the receiver actuator 145 is in a deactivated 799
status. More specifically, the receiver actuator is in a position, wherein the link 800
144 is in a withdrawn position. With the link in a withdrawn position, the bottom 801
guide 148 is also withdrawn as shown. The second guide portion 142 is in a card 802
retention position, wherein the first guide portion 141 and the second guide 803
portion together are configured to receive a card into the card space 149. Cards 804
to be shuffled can be loaded by insertion of the cards through the loading opening 805
162 and placement of the cards onto the support surface 112. A user of the 806
apparatus 100 can start the operational sequence of the apparatus after the cards 807
are loaded into the apparatus 110. Commencement of the operational sequence 808
can be affected by manipulation of the user interface 151, for example. 809

[0091] In response to commencement of the operational sequence, the 810
positioner guides 121 are activated to grip the supported cards 10. Gripping of 811
the supported cards 10 by the guides 121 can be accomplished, for example, by 812
causing the positioner actuators 123 to cause the guides 121 to move and/or exert 813
a force toward each other, thereby squeezing or trapping the cards therebetween. 814

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The exciter 130 is activated in response to commencement of the operational sequence. Activation of the exciter preferably causes the exciter to impart vibratory action to the supported cards 10. For example, as described above, the exciter 130 can be adapted to impart vibratory action to one or more components of the apparatus 100, such as the rest 110. In response to commencement of the operational sequence, the controller 150 can define a starting position of the cards 10 relative to the card aperture 114. This starting position of the cards is preferably randomly selected or generated. The controller can then command the positioner actuators 123 to cause the positioner guides 121 to move the cards 10 to the starting position, while also maintaining a grip on the cards.

[0092] With reference now to Fig. 5, it is seen that the cards 10 have been moved to the starting position. The starting position places the cards 10 above the card aperture 114. More specifically, when the cards are in the starting position, the cards are situated substantially above the card space 149. After the cards have been moved to the start position, the positioner preferably transmits a signal to the controller to indicate that the movement is complete. The controller 150 then preferably commands the positioner 120 to release its grip on the cards. This can be accomplished, for example, by commanding one or more of the positioner actuators 123 to move the positioner guides 121 away from each other so that substantially little force is exerted on the cards by the guides.

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[0093] When the cards 10 are released by the positioner, the cards will come 835
to rest substantially on the support surface 112. Preferably, vibrational action of 836
the support surface will be imparted to the cards 10 supported thereon. 837
Vibrational action is preferably imparted to the support surface by the exciter 130. 838
Impartation of vibrational action to the supported cards 10 will preferably result 839
in a first card 11 dropping from the support surface 112 through the aperture 114 840
into a retained position within the card space 149, as shown. After dropping 841
through the card aperture 114 and into the card space 149, a lower edge of the 842
first card 11 comes to rest substantially on the stop 143. When the first card 11 843
is resting substantially upon the stop 143, the first card has been substantially 844
completely dropped and received into the medial receiver area. 845

[0094] With a lower edge of the first card 11 resting substantially on the 846
stop 143, an opposite upper edge of the first card 11 is substantially flush or even 847
with the support surface 112, as shown. With an upper edge of the first card 848
being substantially even or flush with the support surface 112, the receiver 140 849
and/or the card aperture 114 is substantially blocked or closed so that no other 850
cards can enter the receiver. The sensor 146 preferably detects that the first card 851
11 has dropped into a fully received position within the card space 149. In 852
response to detecting presence of the first card 11, the sensor transmits a signal 853
to the controller 150. The controller 150 receives the signal from the sensor and 854

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interprets the signal to indicate that the first card 11 has been fully received into 855
the medial card space 149. In response to recognizing that the first card 11 has 856
been received into the card space 149, the controller 150 randomly selects or 857
generates a new position of the supported cards 10 relative to the card aperture 858
114. The controller can then command the positioner 120 to move the supported 859
cards 10 to the new randomly selected position. 860

[0095] Turning now to Fig. 6, it is seen that the supported cards 10 have 861
been moved to the new randomly selected position relative to the card aperture 862
114. The positioner 120 preferably transmits a signal to the controller 150 to 863
indicate that movement of the cards 10 to the new randomly selected position is 864
complete. The controller 150 then commands the receiver actuator 145 to activate. 865
Activation of the receiver actuator 145 causes the first card 11 to be released and 866
directed or guided from the card space 149 as shown. The first card 11 preferably 867
drops from the receiver into the collector 161. 868

[0096] In some preferred versions of the invention, the dropping of first card 869
11 from the support rest into the receiver 140 causes the card aperture 114 to be 870
opened or unblocked. With the card aperture 114 unblocked, and as a result of 871
vibrational action of the supported cards 10, a second card 12 begins dropping 872
through the card aperture and into the card space 149 as shown. Sensor 146 can 873
advantageously detect the first card positioned in the card space 149, and transmit 874

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a signal to the controller 150 indicating that the first card is in the stopped 875
position waiting to be directed or released or otherwise guided from the medial 876
card space and into the collector. 877

[0097] Turning now to Fig. 7, it is seen that the second card 12 has been 878
fully received into the receiver 140. More specifically, it is seen from a study of 879
Fig. 4 that the second card has dropped through the card aperture 114, and a lower 880
edge of the second card has come to rest substantially on the stop 143. With a 881
lower edge of the second card 12 resting substantially on the stop 143, an opposite 882
upper edge of the second card 12 is substantially flush or even with the support 883
surface 112. With an upper edge of the second card 12 being substantially flush 884
or even with the support surface 112, it is seen that the card aperture 114 is 885
substantially blocked or closed by the second card. More specifically, with the 886
second card 12 being in a fully retained position within the card receiver 140, the 887
receiver is blocked so that no additional cards can drop and enter into the medial 888
card space. 889

[0098] Further study of Fig. 7 shows that the first card 11 has come to rest 890
within the card collector 161 after having been released from the receiver 140. 891
The sensor 146 preferably detects that the second card 12 has dropped into a fully 892
received position within the card space 149. In response to detecting presence of 893
the second card 12, the sensor transmits a signal to the controller 150. The 894

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controller 150 receives the signal from the sensor and interprets the signal to 895
indicate that the second card 12 has been fully received into the card space 149. 896
In response to recognizing that the second card 12 has been received into the card 897
space 149, the controller 150 randomly selects or generates a new position of the 898
supported cards 10 relative to the card aperture 114. The controller can then 899
command the positioner 120 to move the supported cards 10 to the new randomly 900
selected position. 901

[0099] With reference now to Fig. 8, it is seen that the supported cards 10 902
have been moved to the new randomly selected position relative to the card 903
aperture 114. The positioner 120 preferably transmits a signal to the controller 904
150 to indicate that movement of the cards 10 to the new randomly selected 905
position is complete. The controller 150 then commands the receiver actuator 145 906
to activate. Activation of the receiver actuator 145 causes the second card 12 to 907
be released from the drop card holding space as shown. The second card 12 908
preferably drops from the receiver into the collector 161. Release of the second 909
card 12 from the receiver 140 causes the card aperture 114 to be opened or 910
unblocked. With the card aperture 114 unblocked, and as a result of vibrational 911
action of the supported cards 10, a third card 13 begins dropping through the card 912
aperture and into the card space 149 as shown. The operational sequence 913

described hereinabove can be continued as desired to shuffle a desired number of 914
playing cards. 915

[0100] Turning now to Fig. 9, it is seen that the above-described operational 916
sequence has continued to produce a stack of shuffled cards 20, which are held 917
in the collector 161. The operational sequence continues with a retained card 19 918
shown in a fully received position in the card space 149, and a plurality of 919
supported cards 10 remaining to be shuffled. It is seen that the quantity of 920
supported cards 10 has been depleted as the result of continuation of the 921
operational sequence of the apparatus 100. It can also be seen that the positioner 922
guides 121 have been repositioned relative to each other. Specifically, the 923
positioner guides 121 have moved closer to each other in response to depletion of 924
the quantity of supported cards 10. In this manner, the positioner 120 facilitates 925
maintaining the supported cards in a substantially upstanding orientation. 926
Continued processing of the supported cards according to the operational sequence 927
results in deposition of all cards in the card collector 161. More specifically, upon 928
completion of processing of all cards according to the operational sequence, the 929
shuffled cards can be retrieved from the card collector 161. 930

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ALTERNATIVE ASPECTS AND CONFIGURATIONS 932

[0101] Turning now to Fig. 10, an elevational view shows an apparatus 300 933
 according to an alternative embodiment of the inventions. The apparatus 300 934
 preferably functions in a manner substantially similar to that of the apparatus 100. 935
 However, the apparatus 300 includes alternative aspects and or configurations of 936
 various components. For example, from a study of Fig. 10, it is seen that the user 937
 interface 151 can be mounted in a location relative to the housing 160, which is 938
 different from that of the apparatus 100 (shown in Fig. 1). The positioner guides 939
 121 of the apparatus 300 can have a shape that is different from those of the 940
 apparatus 100. For example, the guides 121 of the apparatus 300 can be 941
 configured to overlap the loading opening 162, as is shown in Fig. 10. As a 942
 further example, the controller 150 can be located substantially within the housing 943
 160, as shown in Fig. 10. 944

[0102] With continued reference to Fig. 10, the positioner 120 can include 945
 a rotary actuator 324, a lead screw 325 and a follower 326. The rotary actuator 946
 324 can be, for example, a rotary electric motor such as a stepper motor or the 947
 like. The rotary actuator 324 is preferably fixedly supported by the housing 160. 948
 The motor 324 is configured to selectively drive or rotate the lead screw 325. 949
 Activation of the motor 324 is preferably controlled by the controller 150. The 950
 connector 326 is engaged with the externally threaded lead screw 325. A follower 951

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forming part of activator 324 is connected causing the lead screws to extend and 952
retract the positioner guides 121. The motor can be selectively activated to rotate 953
in the desired direction, which in turn, causes the lead screw to rotate. Rotation 954
of the lead screw relative to the follower causes the follower and one or more of 955
the guides 121 to move relative to the motor. In this manner, the guides 121 can 956
be positionally controlled. 957

[0103] The exciter 130 can include a coil 131 and vibrational follower 132. 958
The vibrational follower is preferably ferro-magnetic. The coil can be mounted 959
on or supported by the housing 160. The vibrational follower 132 can be mounted 960
on or supported by the rest 111. The vibrational follower can be substantially 961
integral with the rest. The coil 131 can be subjected to intermittent direct current 962
of a given polarity to cause vibrational movement of the vibrational follower 132. 963
Alternatively, the coil 131 can be subjected to current of alternating polarity to 964
cause vibrational movement of the vibrational follower. Such vibrational 965
movement of the vibrational follower is preferably imparted to the rest 111, which 966
in turn, imparts vibrational action to playing cards supported thereon. 967

[0104] With continued reference to Fig. 10, the receiver 140 can have a 968
configuration that is substantially different from that of the apparatus 100 shown 969
in Fig. 1. For example, as shown in Fig. 10, the receiver 140 can include a cam 970
lobe element 344. The cam lobe 344 can have a cross sectional shape 971

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substantially in the form of an ellipse, as shown. The cam lobe element can be 972
rotationally supported by a shaft 349. The shaft 349 is preferably rotatably 973
supported by the housing 160. The shaft 349 is preferably positioned in a manner 974
to place the cam lobe substantially adjacent to the card space 149, into which a 975
card 119 is dropped from the rest 111. 976

[0105] As shown in Fig. 10, the cam lobe 344 is in a card-retaining or card- 977
receiving position, in which a card 119 is retained within the card space 149. 978
More specifically, it is seen from a study of Fig. 10 that the cam lobe has a wider 979
portion and a narrower portion because of its elliptical cross-sectional shape. It 980
is also seen that when in the card-retaining position as shown, the cam lobe is 981
rotationally oriented so that the narrower portion of the cam lobe is substantially 982
adjacent to the card space 149. Thus, rotation of the cam lobe for approximately 983
one-quarter of a turn can cause the wider portion of the cam lobe 144 to move 984
into adjacency with the card space 149. Rotation of the cam lobe 344 985
approximately one-quarter of a turn will preferably cause release of the retained 986
card 119 from the card space 149. More specifically, rotation of the cam lobe 344 987
will preferably cause the retained card 119 to be pushed from its retained position 988
in the card space 149, and to fall into the collector 161. 989

[0106] Fig. 17 shows a further alternative embodiment of shuffler similar 990
to shuffler 100 in almost all respects. The shuffler of Fig. 17 using a jet pulser 991

188 which emits from a nozzle 189 a jet or jets of air or other suitable gas 190. 992
 In operation, the dropping card is not stopped in the medial section but is directed 993
 by the jet or jets of gas so as to come to rest in the receiver 161. 994

[0107] Fig. 18 shows another medial guide configuration have a support 995
 piece 191 which is connected or mounted upon the frame or housing as is 996
 convenient. A guide wheel 192 having vanes 193 perform by directing and 997
 reorienting the dropping cards onto the stack being formed in the receiver 161. 998

999

METHODS AND MANNERS OF USE 1000

[0108] With reference to Fig. 1, a method of shuffling a plurality of playing 1001
 cards 10 includes supporting the cards on an intake support surface 112. The 1002
 method can include supporting the cards on a surface having at least one card 1003
 aperture 114. The cards can be supported in a suitable orientation, for example, 1004
 the cards can be supported substantially on-edge, an preferably upstanding. 1005

[0109] Vibratory action is imparted to the cards. The vibratory action can 1006
 be produced, for example, by an exciter 130, which is described herein above with 1007
 respect to the apparatus 100. The method also includes allowing one or more 1008
 cards to drop into a medial zone advantageously provided with a receiver 140. 1009
 For example, one or more of the cards can be allowed to drop through the at least 1010
 one card aperture in response to imparting the vibratory action to the cards. 1011

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[0110] In some methods, at least one of the dropped cards is retained within the receiver 140 in response to allowing the at least one card to drop. Retaining at least one of the cards includes retaining at least one of the cards so that the retained card substantially blocks the receiver 140 and/or the aperture 114. The method includes repositioning the supported cards relative to the receiver. Repositioning the cards preferably includes moving the supported cards to a randomly selected position relative to the receiver. The method includes releasing the retained card from the receiver in response to repositioning the supported cards. Repositioning of the supported cards can be accomplished substantially by the positioner or repositioner 120.

[0111] The method can include detecting that at least one card is being retained in the receiver. For example, this can include detecting that at least one card has been fully received into a retained position within the receiver. The process of detecting can be accomplished substantially by way of the sensor 146, for example. Repositioning of the supported cards 10 can be performed in response to detecting that at least one card is retained. Retaining the at least one card preferably includes holding the retained card in a position wherein an upper edge of the card is substantially flush or even with the support surface.

[0112] The method can include allowing a plurality of supported cards to sequentially drop into the receiver according to a random sequence. The method

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can also include sequentially retaining each of the dropped cards according to the 1032
random sequence. The supported cards can be repositioned during retention of 1033
each of the plurality of cards. The method can include sequentially releasing each 1034
of the retained cards according to the random sequence. 1035

[0113] The method can include collecting cards that are released through the 1036
card aperture 114. The process of collecting the cards can be accomplished by a 1037
collector 161, which is described hereinabove with respect to the apparatus 100. 1038
The method can include forming a stack of the collected cards. The stack can be 1039
formed by the collector 161, according to at least one embodiment of the 1040
inventions. According to the method, the process of allowing the cards 10 to be 1041
released through the card aperture 114 includes allowing the cards to drop through 1042
the card aperture. 1043

[0114] The process of allowing the cards 10 to be released through the card 1044
aperture 114 can include substantially blocking and/or unblocking the aperture, 1045
according to some preferred method. 1046

[0115] Blocking and/or unblocking the card aperture 114 can also be 1047
accomplished, for example, by a gate system, which can include employing gates 1048
567 to block and unblock the card aperture. The method can further include 1049
sensing whether the card aperture is blocked or unblocked. Selective control of 1050
whether the card aperture 120 is blocked or unblocked can be accomplished, at 1051

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least in part, by a controller 150 and an aperture actuator 119, which are described 1052
hereinabove with respect to the apparatus 100. 1053

[0116] According to at least one embodiment of the inventions, the 1054
apparatus 100 depicted in Fig. 1 can be used in the following manner. A plurality 1055
of cards 10 is selected and is placed onto the card rest 111. For example, the 1056
plurality of cards 10 can be substantially in the form of one or more decks of 1057
cards. Preferably, the cards 10 are placed onto the card support 110 so as to be 1058
substantially supported on the support surface 112. The cards can be supported 1059
by the card rest 111 in one or more of a variety of possible orientations, wherein 1060
the cards 10 are supported on the support surface 112 substantially on-edge. For 1061
example, the cards 10 can be supported in a substantially upright or upstanding 1062
orientation, which includes, but is not limited to, a substantially vertical 1063
orientation. 1064

[0117] The apparatus 100 can be turned on or otherwise activated so as to 1065
be in an operational mode. An operational mode of the apparatus preferably 1066
include imparting vibratory action to the cards 10. Imparting vibratory action to 1067
the cards can include, but is not limited to, imparting vibratory action to the card 1068
rest 111. According to a preferred embodiment of the inventions, vibratory action 1069
is provided by the exciter 130. More preferably, the exciter is adapted to impart 1070
vibratory action to the cards 10 supported on the card rest 111. Additionally, or 1071

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alternatively, the exciter 130 is adapted to impart vibratory action to the card rest 111. 1072
1073

[0118] Preferably, vibratory action imparted to the cards 10 supported on the card rest results in an appearance of the cards dancing or floating on the card rest. 1074
1075
For example, vibratory action imparted to the cards preferably results in the cards bouncing substantially upward and downward while being substantially contained above the card rest. According to at least one embodiment of the inventions, 1076
1077
vibratory action imparted to the cards 10 causes the cards to bounce on the card rest 111, which in turn, results in one or more of the cards falling or dropping through one or more of the card aperture 114. The card aperture can be controlled by a gate system according to at least one embodiment of the inventions. The gate system is preferably adapted to selectively block and/or unblock one or more of the apertures. Such a gate system can include means of employing at least one playing card to block the aperture 114 and/or to block the receiver 140. 1078
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[0119] As cards 10 fall through the card aperture 114, the cards supported on the card rest 111 decrease in number. To compensate for the decreasing number of cards supported on the card rest 111, the positioner 120 can be employed to maintain the cards substantially on-edge while also supported on the card rest. For example, the positioner 120 can include one or more guides that are adapted to move inward toward the cards 10 as the number of cards 1086
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1090
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supported on the card rest decreases. In this manner, the positioner 120 can 1092
function to maintain the cards substantially on-edge while being supported on the 1093
card rest. 1094

[0120] The cards 10 can be collected after they are released through the card 1095
aperture 114 as described hereinabove. Collection of the cards after being 1096
released through the card aperture can be accomplished by a collector 161, which 1097
is described hereinabove with respect to the apparatus 100. Operation of the 1098
apparatus 100 is preferably continued until a desired quantity of cards is either 1099
released from the card rest 111 or collected and/or stacked by the collector 161. 1100
Shuffled cards can be retrieved from the collector. In accordance with at least one 1101
embodiment of the inventions, a plurality of cards can be fed or processed through 1102
the apparatus more than once to increase the degree of shuffling. 1103

[0121] The apparatuses are intended for use with playing cards. In 1104
particular, the apparatuses are especially appropriate for use with plastic playing 1105
cards. 1106

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MANNER AND MATERIALS OF MAKING	1107
[0122] The apparatuses according to this invention may be made using a variety of fabrication and molding techniques. The support actuators are advantageously stepper motors with a coded output for precise control.	1108 1109 1110
[0123] Other parts can be made of metal or plastics of a variety of types now known or hereafter developed.	1111 1112
[0124] The components that touch the cards are advantageously made from Teflon® or other polymer materials that prevent or reduce wear on cards. Also, suitably coated components that have low-friction surfaces of various types may be appropriate.	1113 1114 1115 1116

Claims

1. A card shuffler apparatus, comprising:
a horizontal card support surface configured to receive cards;
a positioner configured to move a group of cards oriented substantially perpendicular to the card support surface in a first direction and a second opposite direction, the first and second directions substantially parallel to the card support surface, the positioner configured to move to a plurality of positions relative to the card support surface; and
a card receiver configured to receive a single card from the card support surface after the positioner moves the group of cards to a position of the plurality of positions relative to the card support surface.
2. The card shuffler apparatus according to claim 1, wherein the card shuffler apparatus is configured to individually release cards from the card support surface in a randomized order and to sequentially pass the released cards into the card receiver in the randomized order.
3. The card shuffler apparatus according to claim 1 or claim 2, wherein the card support surface is configured to support cards in a substantially upstanding on-edge orientation.
4. The card shuffler apparatus according to any one of claims 1 to 3, wherein the card support surface defines a card aperture extending through the card support surface.
5. The card shuffler apparatus according to claim 4, wherein the card aperture is adapted to allow passage therethrough of only one card at a time.
6. The card shuffler apparatus according to claim 5, wherein the positioner is adapted to randomly reposition cards relative to the card aperture.
7. The card shuffler apparatus according to any one of claims 1 to 6, further comprising an exciter configured to impart vibration to the cards over the card support surface.

8. The card shuffler apparatus according to any one of claims 1 to 7, further comprising a gate configured to move relative to the card support surface between a first position and a second position, wherein cards supported on the card support surface are prevented from moving to the card receiver by the gate when the gate is in the first position, and wherein a card supported on the card support surface is allowed to move to the card receiver when the gate is in the second position.

9. The card shuffler apparatus according to claim 8, further comprising an actuator configured to move the gate between the first position and the second position.

10. The card shuffler apparatus according to any one of claims 1 to 9, wherein the card support surface at least partially defines a receptacle configured to receive cards from a user of the card shuffler apparatus.

11. A method of shuffling cards, comprising:
moving a first plurality of cards in a first direction substantially parallel to a card support surface to a first position relative to the card support surface, the card support surface having an aperture therethrough;
transferring a first card through the aperture in the card support surface to a card receiver to leave a second plurality of cards less than the first plurality of cards on the card support surface;
moving the second plurality of cards in a second direction opposite the first direction to a second position relative to the card support surface; and
transferring a second card through the aperture in the card support surface to the card receiver.

12. The method according to claim 11, wherein transferring a first card through the aperture in the card support surface comprises transferring only one card through the aperture in the card support surface, and wherein transferring a second card through the aperture in the card support surface comprises transferring only one card through the aperture in the card support surface.

13. The method according to claim 11 or claim 12, wherein moving a first plurality of cards in a first direction substantially parallel to a card support surface to a first position relative to the card support surface comprises moving the first plurality of cards to a first random position relative to the card support surface, and wherein moving the second plurality of cards in a second direction opposite the first direction to a second position relative to a card support surface comprises moving the second plurality of cards to a second random position relative to the card support surface.

14. The method according to any one of claims 11 to 13, further comprising collecting cards played in a playing card game and placing the cards played in the playing card game over the card support surface to form the first plurality of cards.

15. The method according to any one of claims 11 to 14, further comprising removing cards from the card receiver and using the cards removed from the card receiver in a playing card game.

16. The method according to any one of claims 11 to 15, further comprising supporting the first plurality of cards and the second plurality of cards in an upstanding on-edge orientation over the card support surface.

17. The method according to any one of claims 11 to 16, further comprising vibrating the first plurality of cards and the second plurality of cards.

18. The method according to claim 17, wherein vibrating the first plurality of cards and the second plurality of cards comprises vibrating the first plurality of cards and the second plurality of cards at a frequency in a range from about 10 Hz to about 100,000 Hz.

19. A card shuffler apparatus, comprising:
a receptacle in which a user of the card shuffler apparatus may place a plurality of cards in a substantially vertical orientation;
a positioning mechanism configured to randomly reposition the plurality of cards horizontally in two opposite directions in the receptacle;
a transfer mechanism configured to individually release cards responsive to gravity from the receptacle in a randomized order; and
a card collector for receiving cards individually released from the receptacle and from which the received cards may be removed from the card shuffler apparatus by the user of the card shuffler apparatus.

20. The card shuffler apparatus of claim 19, further comprising an exciter configured to cause the plurality of cards in the receptacle to vibrate.

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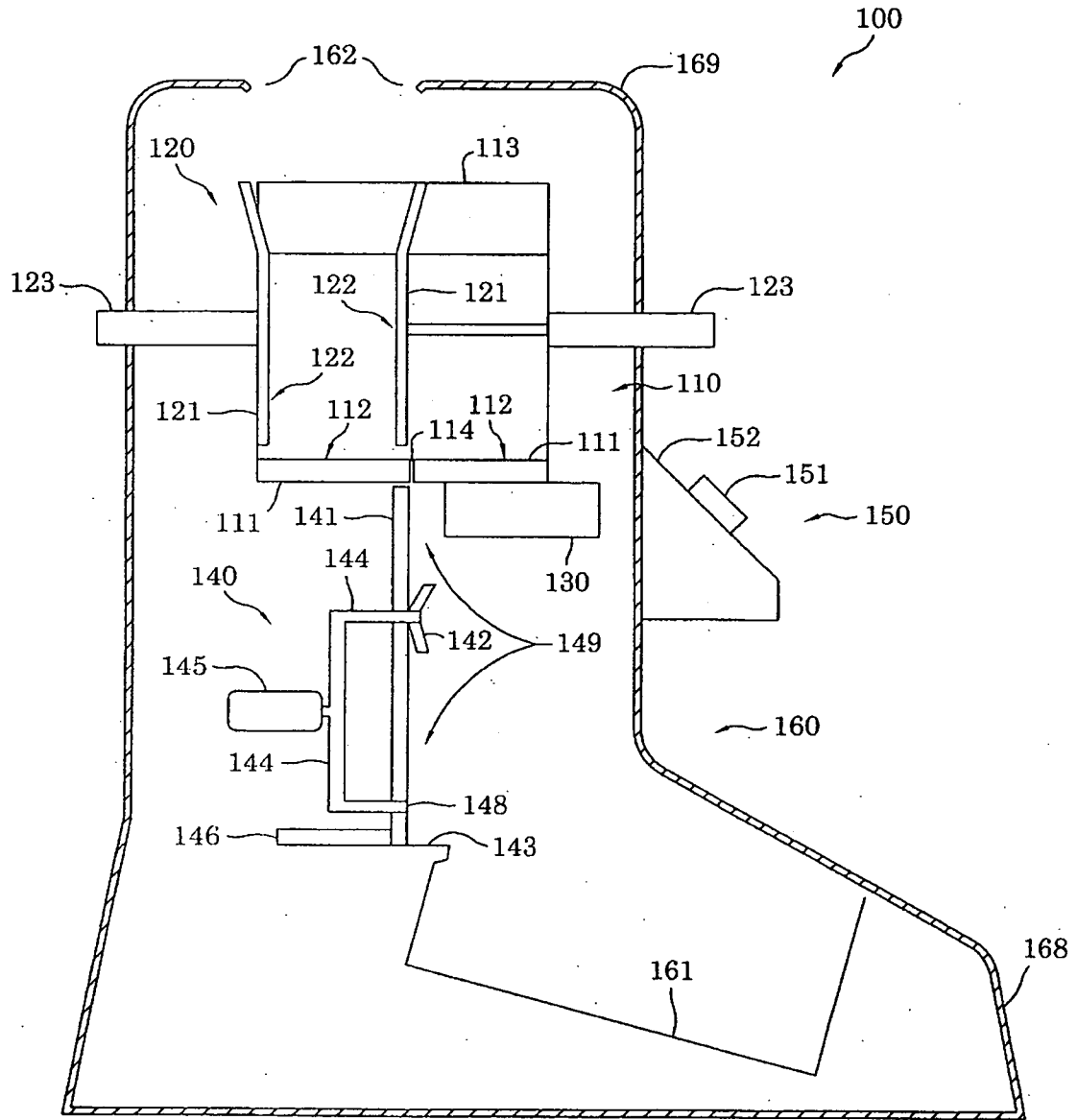


Fig. 1

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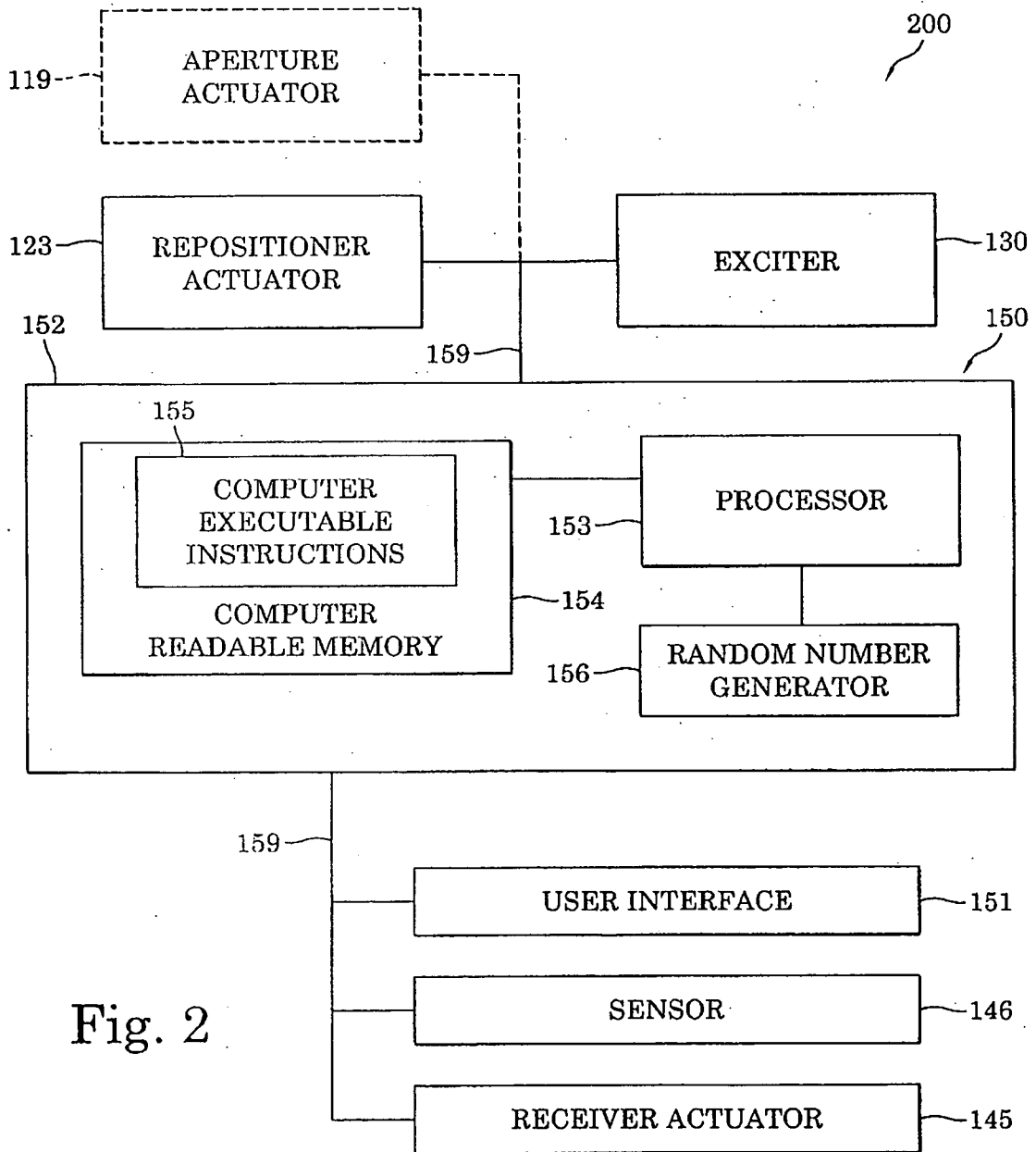


Fig. 2

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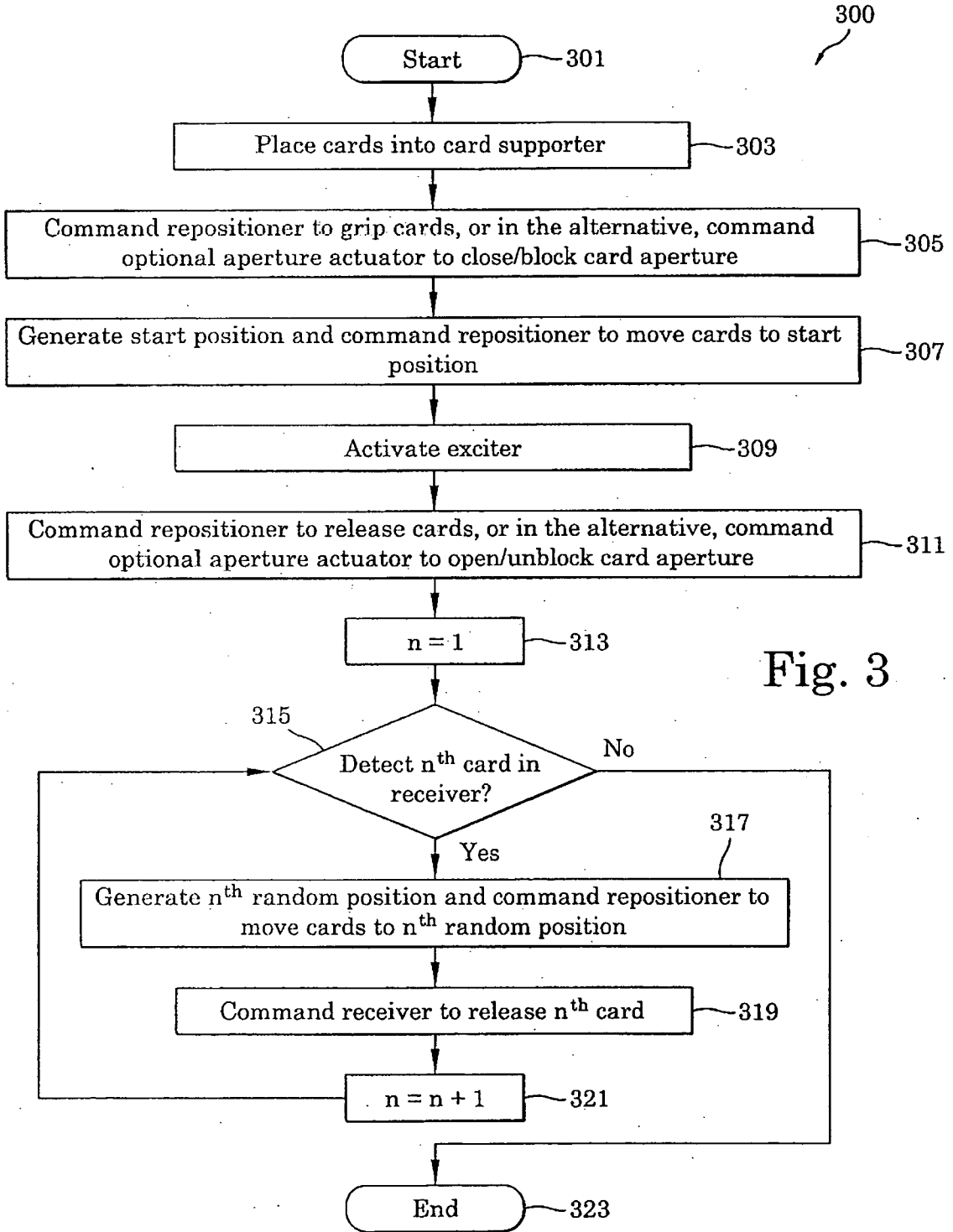


Fig. 3

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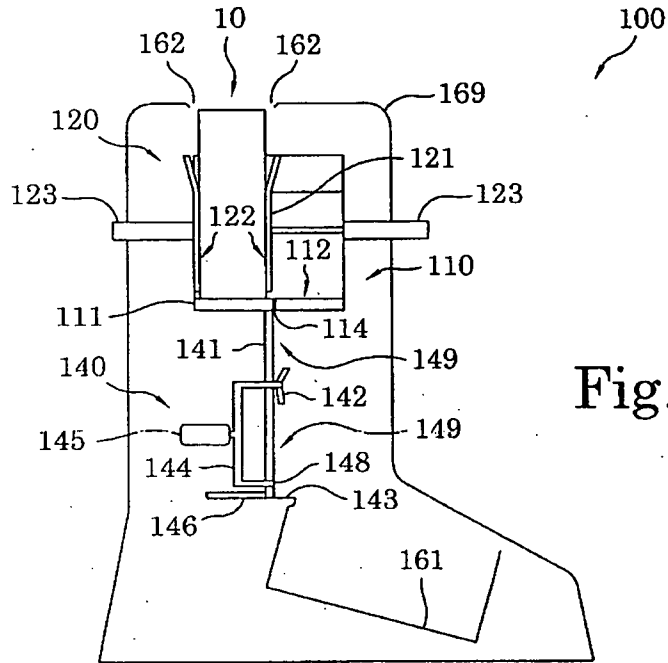


Fig. 4

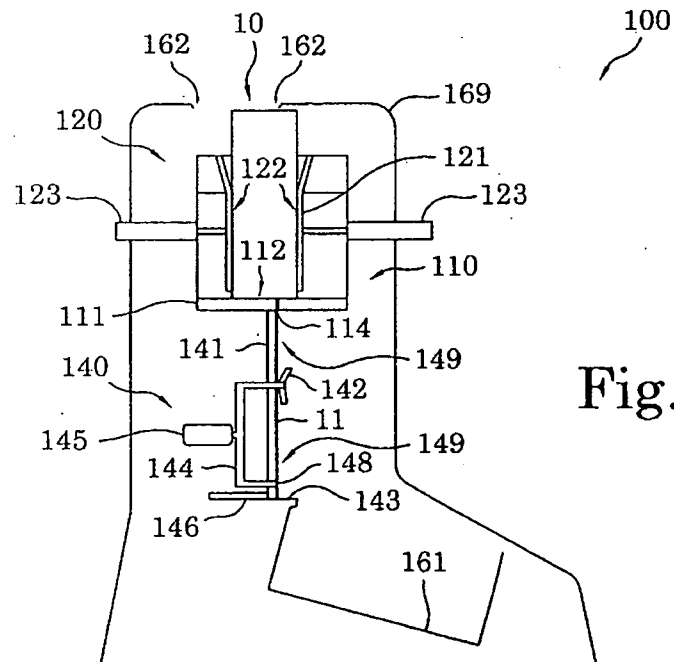


Fig. 5

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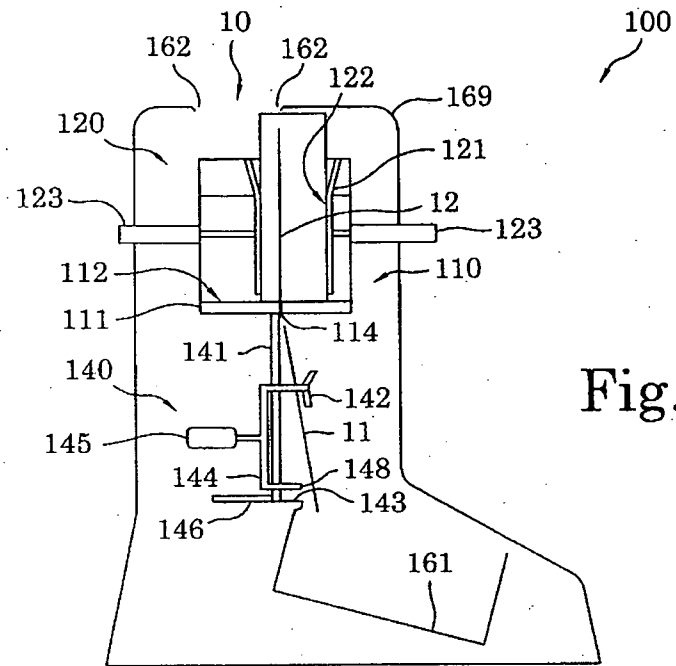


Fig. 6

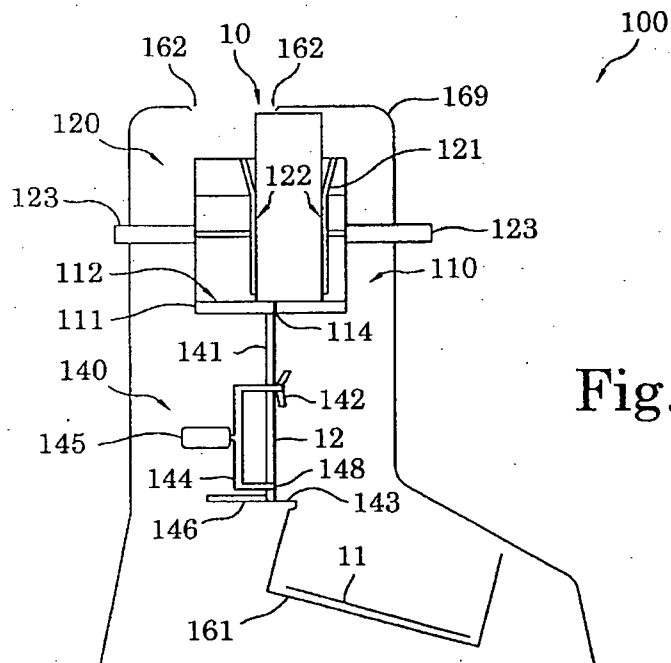


Fig. 7

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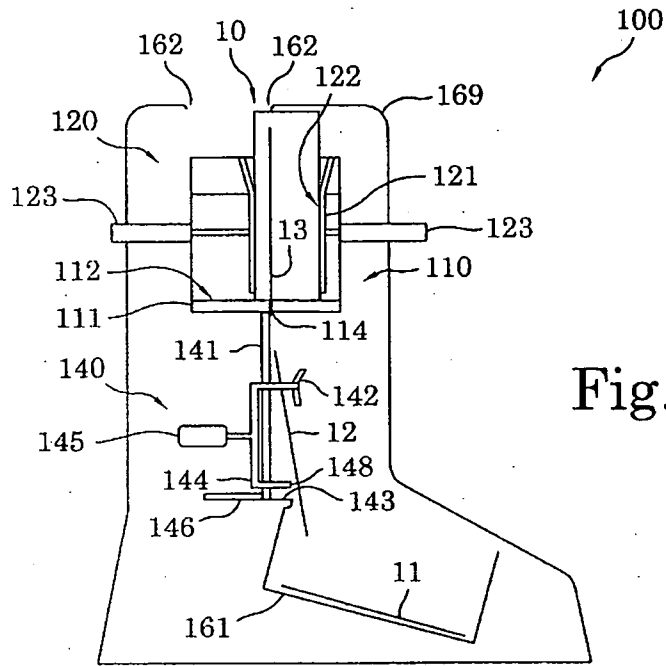


Fig. 8

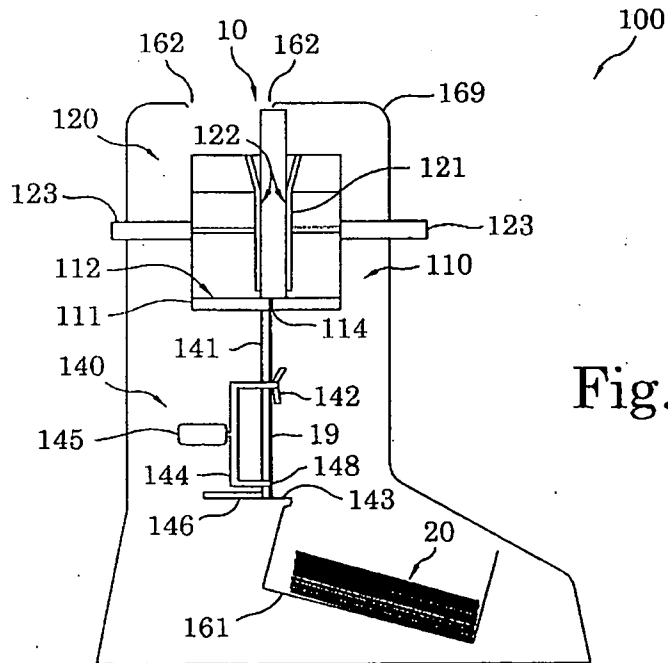


Fig. 9

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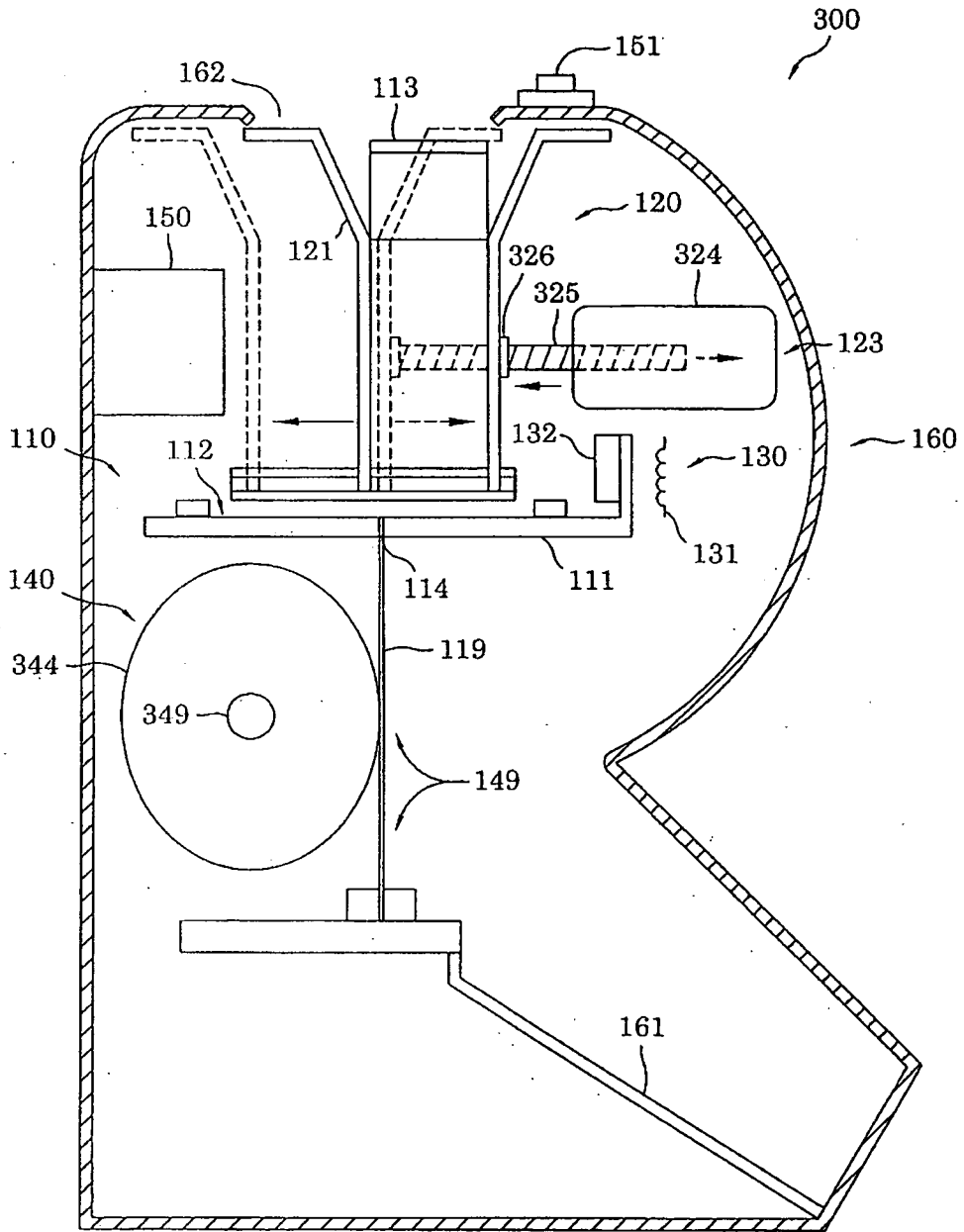


Fig. 10

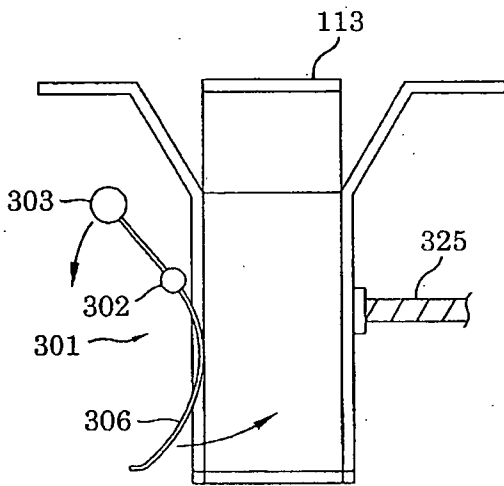


Fig. 11

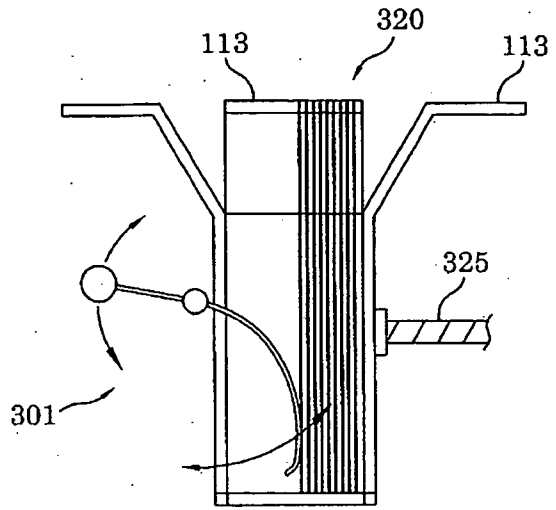


Fig. 12

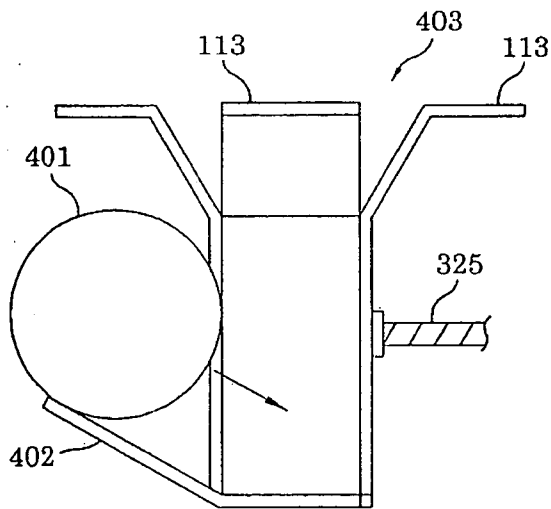


Fig. 13

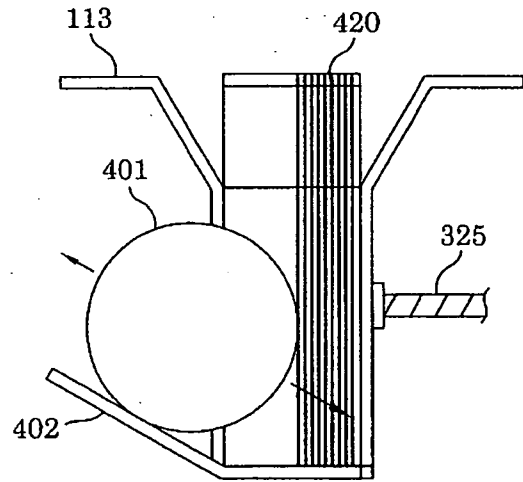


Fig. 14

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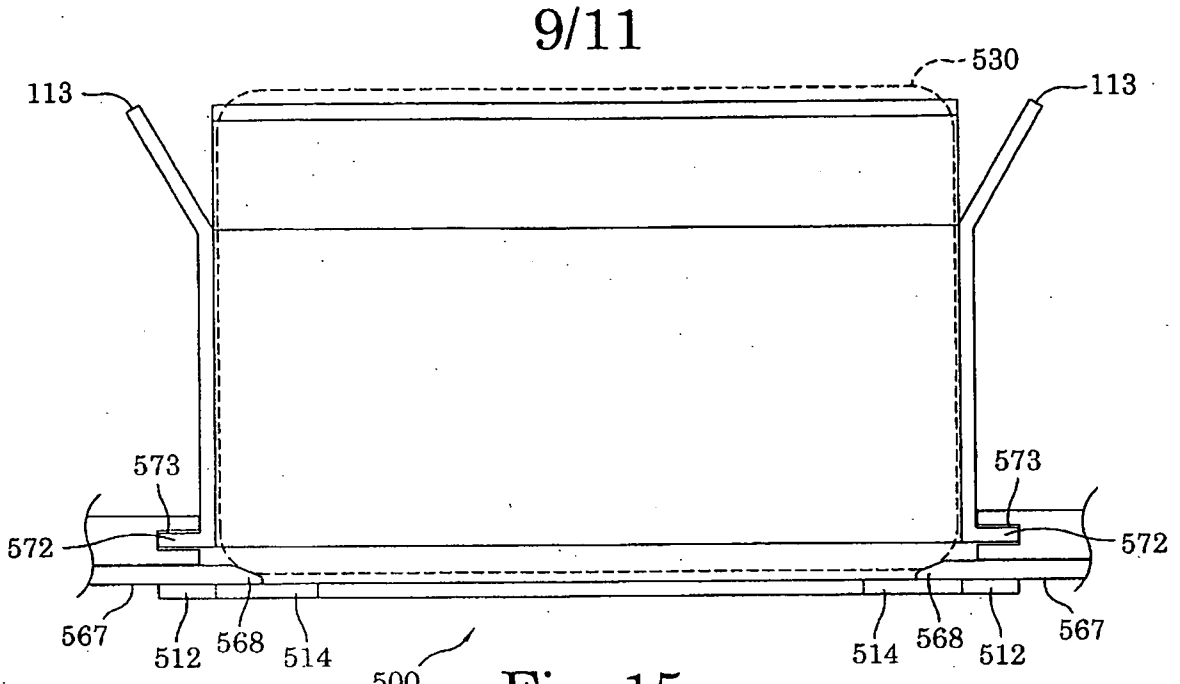


Fig. 15

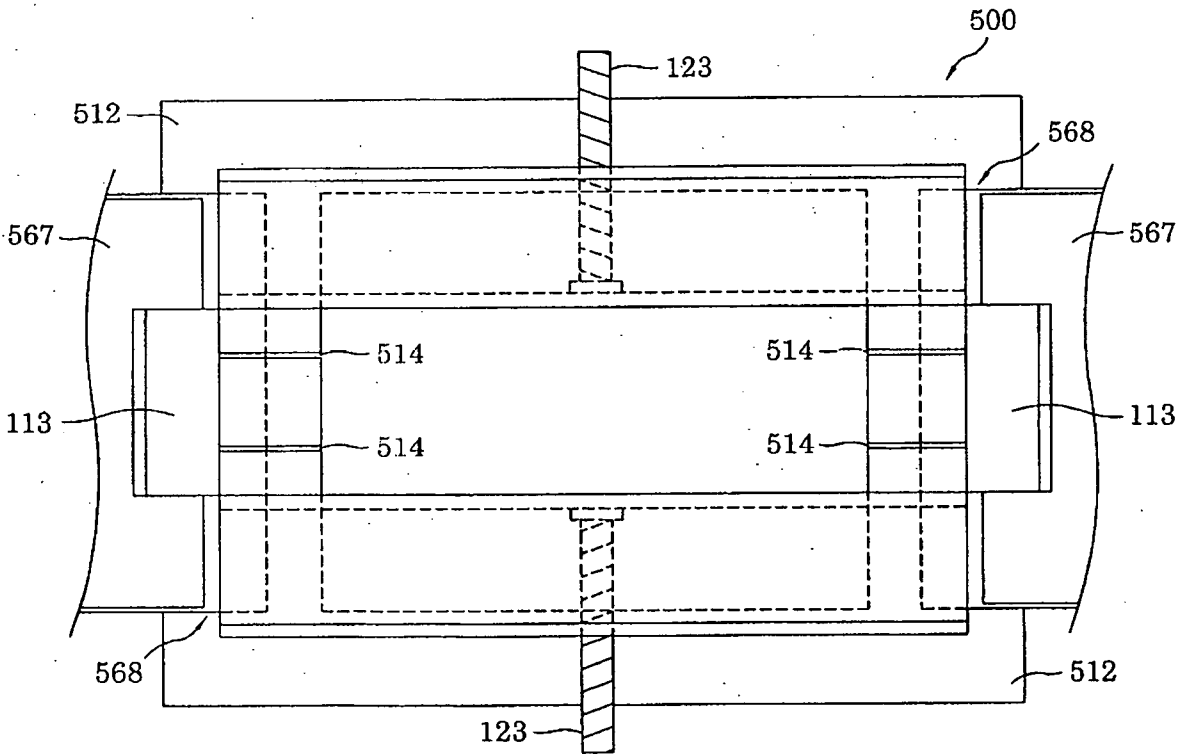


Fig. 16

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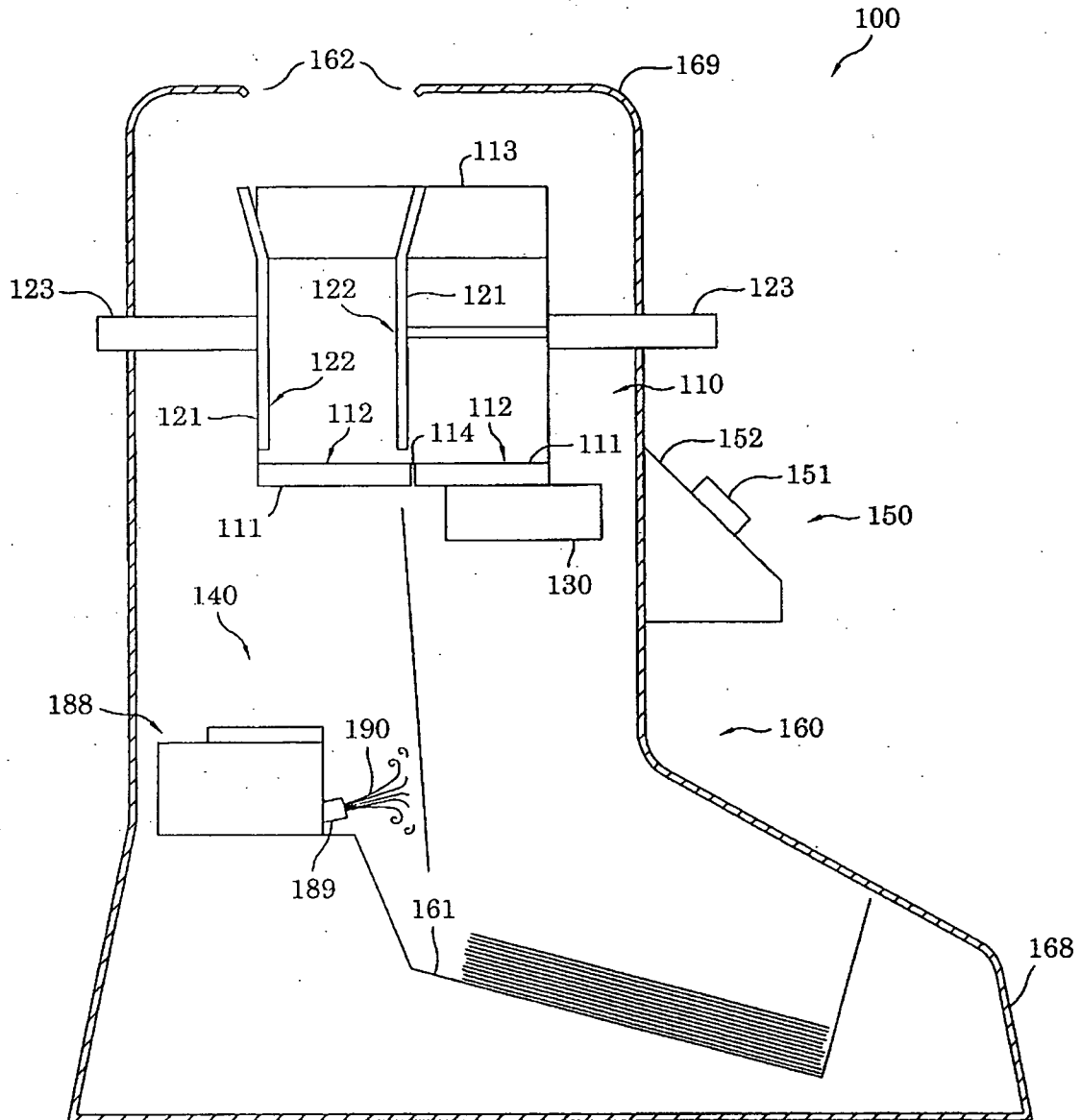


Fig. 17

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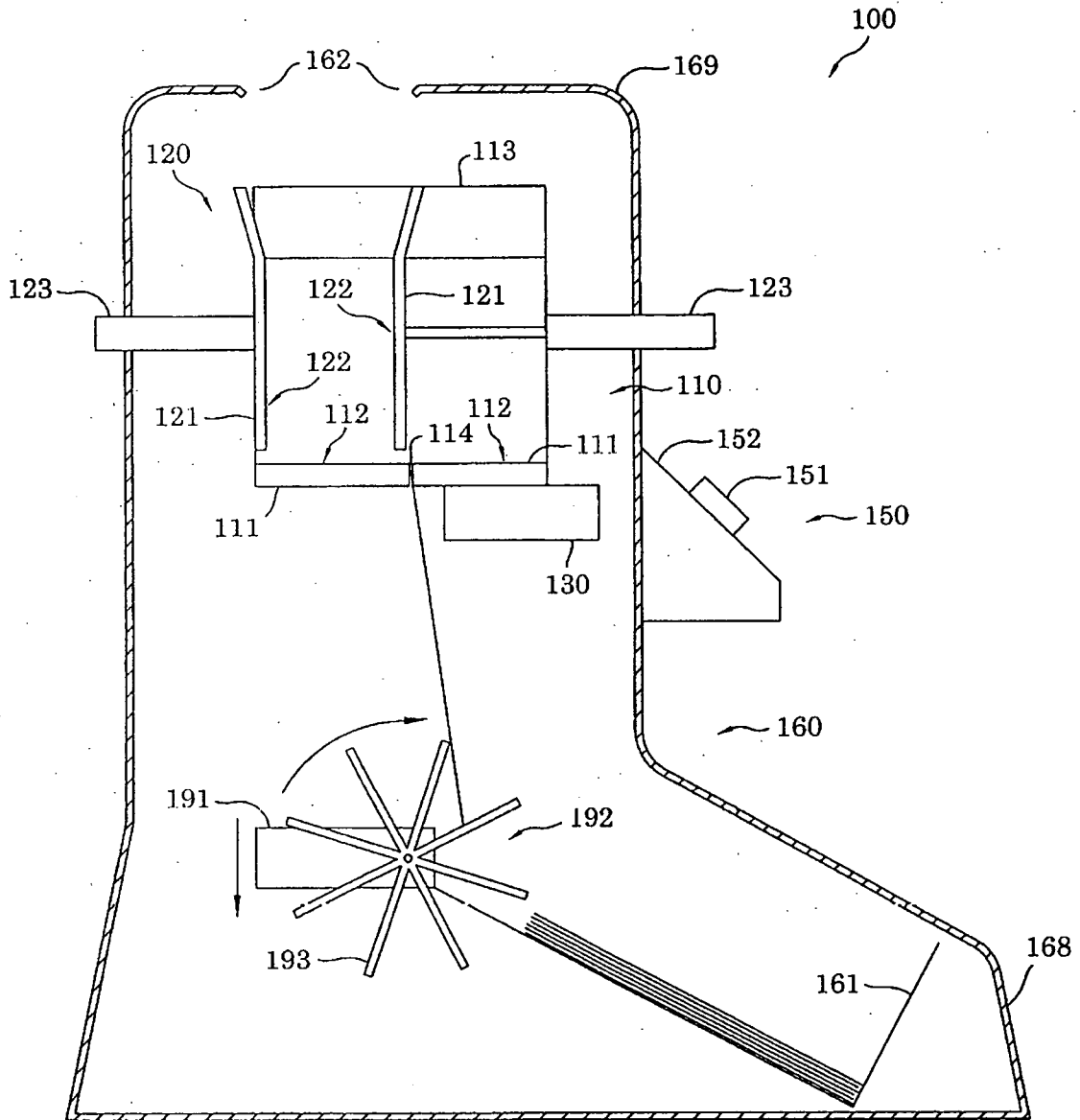


Fig. 18