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CARD SHUFFLERS

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2 Sheets-Sheet 1

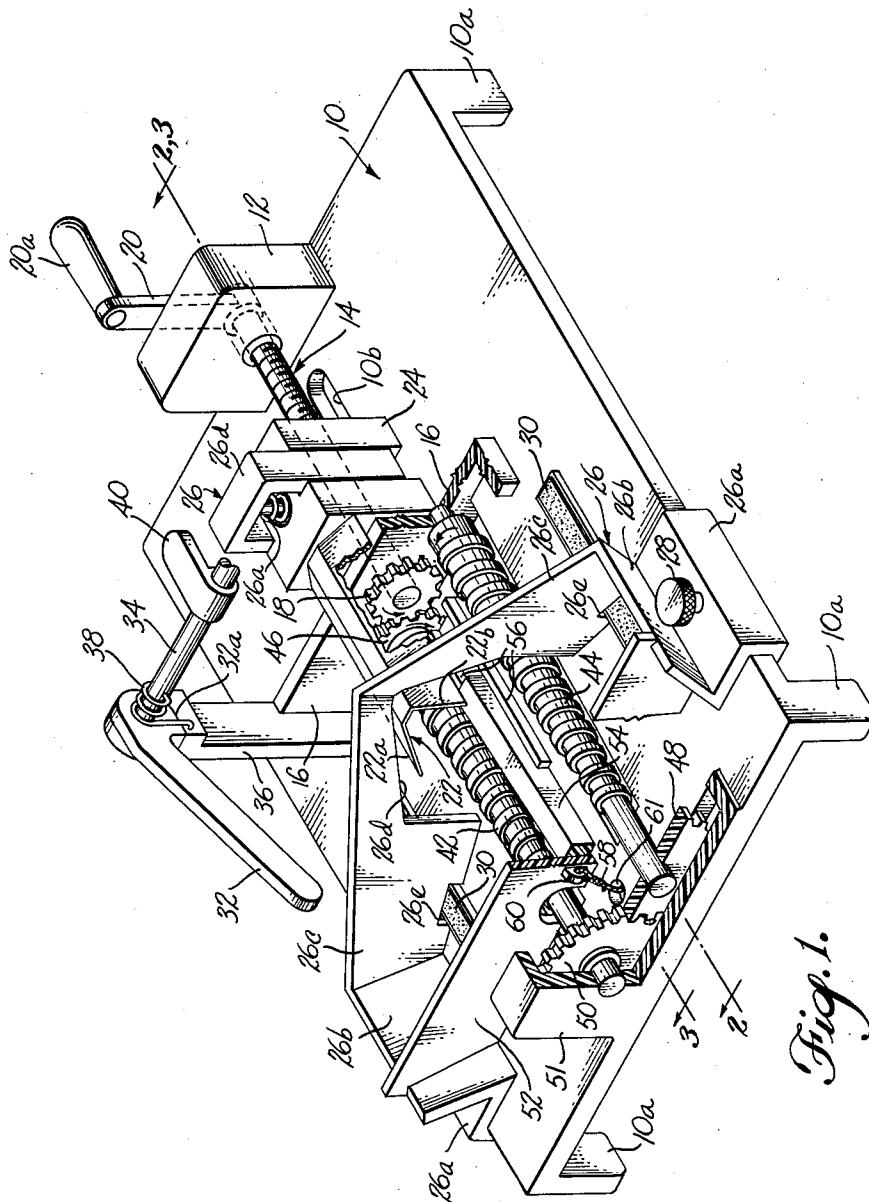


Fig. 1.

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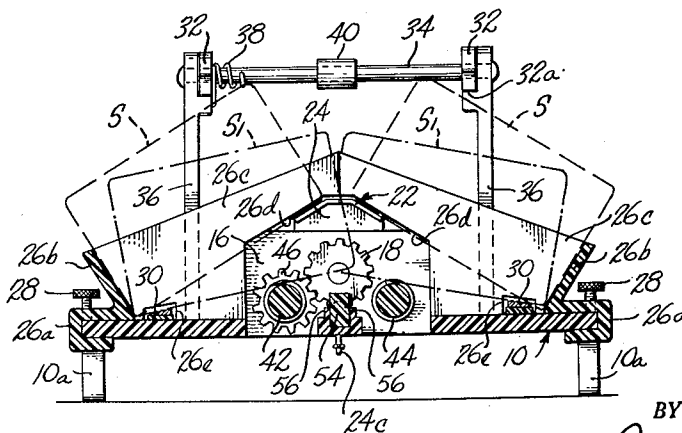
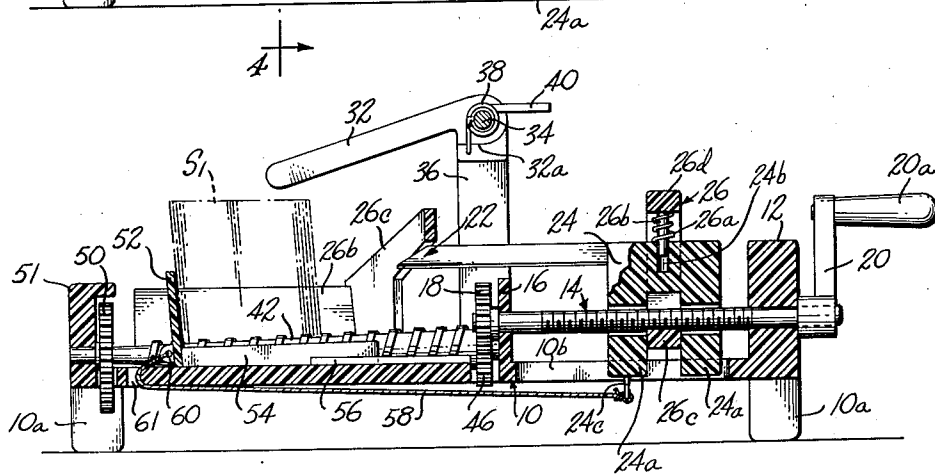
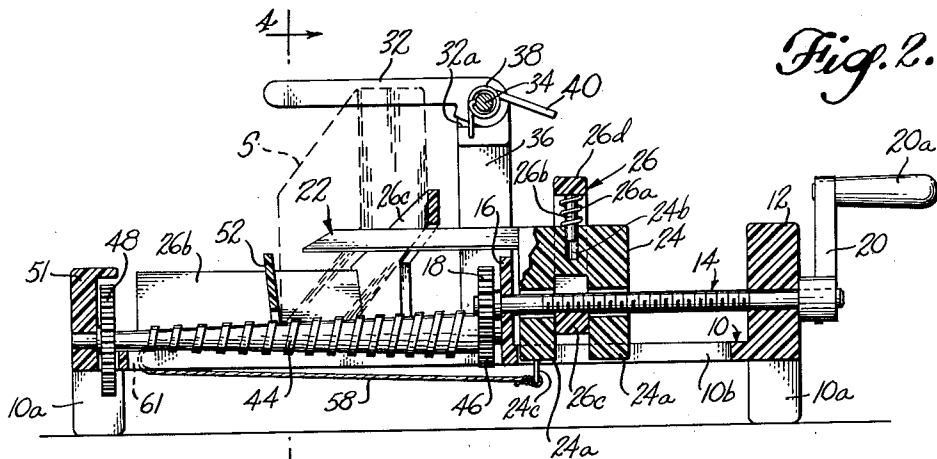
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CARD SHUFFLERS

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Application October 28, 1954, Serial No. 465,183

15 Claims. (Cl. 273—149)

This invention relates to a novel device for shuffling a pack of playing cards in the desired random fashion, and is herein illustratively described by reference to its presently preferred form. It will be recognized, however, that certain changes therein with respect to details may be made without departing from the essential features comprising the invention.

While many card players prefer to shuffle the pack by hand when the pack comprises a deck of fifty-two cards or less, it becomes very difficult to do this when a pack of the size of two or three such decks is used as in some of the currently popular card games. Various proposals have therefore been made for card shuffling machines capable of shuffling card packs of varying sizes or thickness. Also, the use of a card shuffling machine tends to remove all question as to whether the pack has been shuffled properly or completely.

An object of the present invention is a card shuffling device which shuffles a pack of cards thoroughly and in random fashion or at least sufficiently so to achieve satisfactory results.

Another object is a reliable card shuffler which is relatively easy to operate and not overly expensive to manufacture. Still other objects include such a card shuffling device which will not damage the cards, which will handle a card pack of virtually any normally encountered thickness, and one which does not rely on friction rolls or the like to advance the cards into shuffled relationship by an alternate feeding of top cards or bottom cards from two stacks as in certain prior machines.

Described in brief terms, the improved device in its preferred form comprises means to support a pack of cards divided into two sections disposed standing on edge generally in horizontally extending end-to-end relationship with the mutually adjacent ends of the two sections tilted upwardly and spaced apart slightly and held in this upwardly tilted position by a retractable supporting ledge which is operable to retract progressively from beneath the cards to permit such cards to drop off the end of such ledge in more or less random alternate fashion and thereby swing downwardly into overlapping relationship of their mutually adjacent ends. An important additional feature of the device resides in the supporting of the pack sections with some angularity initially between their general planes and the provision of conveyor means extending beneath and in the line of retraction movement of the ledge to catch and support the dropping cards and to advance the overlapping ends thereof toward general parallelism of adjacent cards, thereby further to increase the area of overlap of the dropped cards and continuously to provide ample space adjacent the ledge means into which other cards from the pack may drop without hindrance from those already resting on the conveyor means. As a further feature the device includes a retracting end rack extending transversely of the conveyor means and against which the cards may lean standing on edge on the conveyor

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means. Such end rack is retracted away from the card pack at substantially the same rate as the rate of retraction of the ledge element, so as to accommodate the increasing number of cards accumulating on the conveyor means.

These and other features, objects and advantages of the invention will become more fully evident from the following description thereof by reference to the accompanying drawings.

Figure 1 is a perspective view of the preferred form of the novel card shuffler with parts broken away to show details of construction.

Figure 2 is a longitudinal sectional view taken in a vertical plane on line 2—2 in Figure 1, showing by dotted lines one portion of a pack of cards held in upwardly tilted position on the ledge means ready for retraction of the latter to shuffle the pack.

Figure 3 is a view similar to Figure 2 taken on line 3—3 in Figure 1, in which the pack of cards shown by broken lines has been shuffled and rests on the conveyor means in readiness to be taken from the machine.

Figure 4 is a transverse sectional view taken on line 4—4 in Figure 2 and illustrating by dashed and broken lines the two positions of the cards in the respective sections of the pack during operation of the machine.

The machine is provided with a generally rectangular base 10 having corner legs 10a formed to support the base horizontally on a table top or the like. At one end of the base 10 an upwardly projecting journal block 12 is centrally positioned, and is apertured to rotatively support one end of the externally threaded screw shaft 14. The screw shaft 14 extends in horizontal position longitudinally of the base 10 and its opposite end is rotationally supported in the upwardly projecting transverse plate 16 mounted on the base in a longitudinally intermediate position thereon. A spur gear 18 is fixed on that end of the screw shaft 14 which projects through and beyond the aperture in the supporting plate 16. A crank 20 with handle 20a is fixed on the opposite end of the screw shaft 14 for rotation of such shaft, to operate the machine by turning of the crank, as will later appear.

A longitudinal slot 10b is formed along the longitudinal centerline of the base 10, that is beneath screw shaft 14, to serve as a guide for the slider block 24. The latter rests on the base 10 and has tongue members 24a projecting downwardly into the slot to slide lengthwise therein. The screw shaft 14 passes freely through an unthreaded aperture in the block 24 to permit travel of the block along the slot. The slider block 24 carries a nut unit 26 which is normally drivingly engaged with the threads of the screw shaft 14 such that rotation of the screw in one sense or the other produces travel of the slider block lengthwise of the slot 10b in a corresponding direction. The nut unit is of open rectangular form having opposite sides slidably received in grooves formed vertically in opposite sides of the block 24, and having a transverse bottom member 26c formed as a segment of an internally threaded nut normally bearing upwardly against the lower side of the threaded portion of the screw shaft 14, such threaded bottom member 26c being received in a deep groove formed transversely in the bottom of the block 24. A coil spring 26a encircling a guide pin 26b is interposed between the top side of the block 24 and the underside of the top transverse member 26d of the nut unit. The pin 26b is slidably socketed in the hole 24b in the top of the block. The force of the spring maintains driving engagement between the nut unit and the screw shaft. However, by pressing downwardly on the nut unit to compress the spring the nut unit is disengaged from the shaft and may be slid manually into any

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desired location along the slot 10b without turning of the crank 20a.

The principal function of the slider block 24 is to support the ledge member 22 and to retract such member progressively from beneath a divided pack of cards as previously described in order to cause the mutually adjacent ends of the elevated cards to drop off the ledge in more or less random fashion from the two sections of the pack and into overlapping or shuffled relationship as the ledge member retracts from beneath the cards. It is found that the cards dropped off the ledge in that manner are well intermixed and, of course, by repeating the process a more thorough shuffling may be obtained. Such ledge member projects cantilever fashion from that end of the slider block 24 lying opposite the end facing the crank 20a and preferably is centrally located transversely of the base 10 so as to overlie the axial line of the screw shaft 14. Such ledge member has laterally sloping sides 22a and 22b, which decline outwardly from the longitudinal centerline thereof preferably at a slope representing the desired angle of upward tilt of the sections of a card pack in their described initial position resting edgewise on the respective ledge member sides. The projecting end edges of the sloping sides of the ledge member preferably form an acute angle with the respective lower and laterally outer longitudinal edges thereof such that progressive retraction of the ledge member from beneath the card pack sections, as later explained, causes the cards to be supported by a progressively decreasing side surface width until finally the outermost cards are supported only by the tips or corners of the ledge member and will abruptly drop off the ledge member upon slight further retraction thereof to achieve the desired interleaving of cards.

As previously mentioned, when the cards are to be placed in the machine for shuffling, the pack is divided approximately in half and the two sections or halves are placed in generally end-to-end relationship with their mutually adjacent ends resting on respectively opposite sides of the ledge member 22. The lower or outer ends of the pack sections rest on the properly located longitudinal rails 30, the top surface of which is sanded or provided with other frictional material (see Figures 2 and 4 wherein the symbol S designates the pack sections in such position). In order to support the pack sections on edge in this manner the free end of the cantilever ledge member 22a projects through an archway 26d formed by the two vertical panels 26c or reference surfaces against which the pack sections are placed and supported in upright position. The plates 26c form a dihedral angle of about 150° directed away from the crank end of the machine, and the outer ends of the plates 26c are supported by connection to one end of longitudinally extending outwardly inclined plates 26b which in turn are formed integrally with the slider channels 26a engaging the respective opposite edges of the base plate 10. The slider channels, hence the entire structure including plates 26a and 26b may be adjustively positioned longitudinally of the base and locked in any adjusted position by tightening of the clamp screw 28. Notches 26e in the bottoms of the respective reference plates 26c provide clearance for the card supporting rails 30. The inclination angle of the plates 26b corresponds substantially to the tilt angle of the end edges of the cards supported on the ledge member 22, and these plates serve as secondary reference surfaces against which the ends of the cards are abutted to establish the desired slight relative spacing between pack sections.

Spring-operated hold-down arms 32 press downwardly against the tops of the respective card pack sections to hold them in upright position resting on the ledge member 22 and rails 30 and abutted against the reference plates 26c and 26b. These hold-down arms are fixed on a common rocker shaft 34 journaled in fixed uprights 36 projecting upwardly from the opposite ends of the stationary frame plate 16. A helical spring 38 encircling the rocker shaft 34 has one end fixed to the shaft and its

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opposite end anchored to one of the uprights 36 so as to urge the hold-down arms 32 downwardly toward a lower limit position established by abutment of the top surfaces of the uprights 36 and a bearing surface 32a (Figure 1) at the base of each arm. A lever arm 40 fixed on the shaft 34 intermediate the uprights 36 provides a convenient handle for rocking the shaft 34 in a sense to raise the hold-down arms initially for insertion of the card pack sections in the machine.

It will thus be apparent that means are provided for positioning and stably holding the two sections of a card pack in the machine with the described positional relationship between the sections so that as the ledge member 22 is progressively retracted through the archway 26d the cards will commence to drop in random alternate succession from the two upwardly tilted sections. The transverse spacing between the reference plates 26b in relation to the length of a standard size playing card is made such that as the cards drop from elevated position on the ledge member their adjacent ends will swing through arcuate paths and move into overlapping relationship, whereas when resting on the ledge member 22 the adjacent ends of the cards in the respective pack sections were spaced slightly from each other. A slight amount of overlap is thus achieved merely by dropping of the cards off the corners of the ledge member 22. The amount of this overlap is increased thereafter by reason of the operation of the two conveyor screws 42 and 44 stationed on opposite sides of the longitudinal centerline of the machine and beneath the ledge member to form supporting elements for the cards in the respective pack sections in their lower position represented by the symbol S₁ (Figures 3 and 4). Opposite ends of the conveyor screws are rotationally supported in the fixed journal plates 16 and 51, respectively. The conveyor screw 42 is rotated by a spur gear 46 meshed with the spur 18, whereas the opposite-pitch conveyor screw 44 is rotated in the relatively opposite sense by means of a spur gear 48 fixed on the shaft of screw 44 and meshing with a similar spur gear 50 fixed on the shaft of screw 44 and meshing with a similar spur gear 50 fixed on the shaft of screw 42 (Figure 1). The base 10 is slotted and grooved as necessary to provide clearance spaces not only for the gears but also for the conveyor screws as illustrated. The conveyor screws 42 and 44 are spaced short distances from the longitudinal centerline of the machine so as to support the respective card sections near their mutually adjacent ends. These conveyor means have oppositely inclined threads and rotate in opposite directions so as to advance the overlapping ends of the dropped cards in the direction away from the ledge member, thus swinging such cards toward parallelism and effecting an increase in the degree of overlap of such cards, and also continuously providing a clear space adjacent the end of the retracting ledge member 22 into which other cards may freely drop. Preferably the conveyor screws are tapered to provide downward slope to their upper peripheral sides in the direction of card advance thereon.

As the cards drop from the ledge member 22 and onto the respective conveyor screws 42 and 44, they tend to tip over, that is to fall in the direction away from the ledge member, but are prevented from so doing by provision of a transverse plate or end rack 52 against which the dropped cards may lean. This end rack is fixed to a slider bar 54 which runs on the top of base plate 10 between longitudinal guide strips 56 so as to permit longitudinal adjustment of the end rack in the direction of feed of the conveyor screws to permit the end rack to be positioned initially closely adjacent the projecting end of the ledge member 22 and also to permit such end rack to be retracted progressively away from the reference plates 26c as the number of cards increases which have dropped onto the conveyor screws. Such retraction movement of the end rack 52 is accomplished automatically by any

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suitable means such as the tie cord 58 which fastens to an eye 60 on the back side of the end rack 52 and passes through a direction reversing aperture 61 in the base 10 to extend lengthwise of the machine beneath the base to an anchor member 24c on the bottom of the traveling slider block 24 (Figures 2 and 3). Thus as the ledge member 22 is retracted by rotation of the feed screw 14 the end rack is progressively retracted in the opposite sense at the same rate. Preferably the card supporting rails 30 are connected to the retracting end rack so that in conjunction with the conveyor screws 42 and 44, they shift the dropped cards bodily away from the retracting ledge member and insure a clear space into which succeeding cards may drop off the ledge.

In order to operate the machine the slider channels 26a are adjustively positioned at a location lengthwise of the base plate 10 so as properly to locate the reference plates 26c with relation to the size of the card pack to be shuffled. With downward pressure exerted on the nut unit 26 to disengage its threads from the screw shaft 14, the slider block 24 carrying the ledge member is quickly advanced toward the opposite end of the machine to project the end of the ledge member a sufficient distance through the archway 26d and provide the requisite length of ledge surface for the sections of the pack. With the lever 40 pressed downwardly in order to raise the hold-down arms 32 against the force of spring 32a, the pack sections are then placed in the machine with corresponding sides resting in contact against the respective reference plates 26c and with the lower edges of the cards resting on the respective rail surfaces 30 and on the respective sloping sides of the ledge member 22. The lever 40 is then released, permitting the hold-down arms 32, under spring pressure, to hold the cards in this position. The end rack 52 is thereupon advanced toward the ledge member to take up the slack in the pull cord 58 and position such end rack near the cards so that as the latter drop from the end of the ledge member they will have the end rack 52 against which to lean and thereby will continue to remain on edge after they have dropped onto the conveyor screws 42 and 44. Thereupon the crank is turned to rotate the screw shaft 14 in the direction which causes retraction of the ledge member 22 back through the archway 26d. The cards do not move with the ledge member since they are abutted against the reference plates 26c and the only effect of any frictional contact between the lower edges of the cards and the sloping sides 20a and 20b of the ledge member is to compress the pack sections together as the ledge member retracts. When the endmost cards in the pack sections, that is, those cards remote from the reference plates 26c, are reached by the respective end corners of the ledge member 22, these cards drop abruptly (swing downward about rails 30 as pivotal supports) to a lower position in which they rest on the respective screw conveyors 42 and 44, then being rotated by the gear trains as a result of screw shaft rotation. Initially as these cards drop onto the screw conveyors they retain the angular relationship initially established by the angularity between the blades 26c. However, as the screw conveyors continue to advance the mutually adjacent overlapping ends of the dropped cards toward the end rack 52 at a rate faster than the rate of retraction of the end rack 52 and supports 30, the cards are moved progressively toward substantially coplanar relationship or parallelism, and the amount of overlap incurred in the dropping of the cards off the ledge member is increased to assure a sufficient overlap so that when the cards are removed from the machine the overlap will not be lost in the handling. Furthermore, as previously mentioned the advancement of the dropped cards by the conveyor screws 42 and 44 affords continuous clearance or space adjacent the end of the ledge member so that succeeding cards will drop freely into overlapping relationship onto the conveyor screws and will not be wedged between cards already

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dropped and the corners of the ledge member. The hold-down arms 32 are prevented by their abutment surfaces 32a from contacting and interfering with the advancement of cards resting on the conveyor screws 42 and 44. The entire operation may be effected in a fraction of a minute with a little experience in handling the cards and operating the machine.

I claim as my invention:

1. In a card shuffler for operating on a pack of cards divided into two approximately equal sections, holder means to support the pack sections initially standing on edge, extending generally horizontally in end-to-end relationship and at least approximately lying in a common vertical plane, with slight relative horizontal spacing between mutually adjacent ends of such pack sections, said holder means including outer support elements contacting the lower edges of the cards solely near their relatively outer ends, and inner support means supportingly contacting such cards solely near their mutually adjacent ends to hold such cards against swinging downwardly about said outer support elements as fulcrums, means supporting said inner support means to permit retraction thereof progressively from card supporting position in a direction generally transverse to the cards, thereby permitting the mutually adjacent ends of said cards successively to drop off said inner support means and the cards to fulcrum downwardly about said outer support elements and into generally intermixed overlapping relationship, and alternate inner support means disposed beneath said retractable inner support means in position to catch the downwardly fulcruming cards and hold the same on edge in such overlapping relationship said alternate inner support means being spaced a distance below said retractable inner support means such that the cards remain in such overlapping relationship with the outer ends thereof remaining on the outer support elements.

2. The card shuffler defined in claim 1, wherein the holder means additionally comprises abutment elements positioning the pack sections initially with slight angularity between their respective general planes, diverging in a direction opposite to the direction of retraction of the retractable inner support means, and wherein the alternate inner support means comprises conveyor means operable conjointly with retraction of the retractable inner support means to advance the cards dropping from the latter in the direction opposite from such direction of retraction, thereby swinging such cards toward generally parallel relationship.

3. The card shuffler defined in claim 2, and end rack means extending transversely to the line of retraction of the first-mentioned inner support means and disposed in generally upright position to hold upright the dropped cards resting on edge on the conveyor means, and means operable conjointly with retraction of the first-mentioned inner support means to retract said end rack means oppositely thereto at substantially the same rate.

4. The card shuffler defined in claim 3, wherein the conveyor means comprise two screw conveyor elements extending parallel to the line of retraction of the first-mentioned inner support means and lying in substantially a common horizontal card-supporting plane.

5. The card shuffler defined in claim 4, wherein the screw conveyor elements are tapered in diameter in the direction of their length in the sense opposite from the direction of retraction of the first-mentioned inner support means.

6. The card shuffler defined in claim 4, wherein the means for retracting the first-mentioned inner support means comprises a traveling nut element and a screw shaft extending parallel to said line of retraction engaged by said traveling nut element and rotatable to effect progressive retraction of said first-mentioned inner support means thereby, and the means effecting retraction movement of the end rack means comprises a pull cord fastened at one point to such end rack means and at a

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different point to the traveling nut means, with stationary means forming a direction-reversing bend in said pull cord, whereby the traveling nut means and the end rack means move in opposite directions simultaneously, and means drivingly connecting said screw shaft to the conveyor screws.

7. A card shuffler comprising means to support a pack of cards divided into two sections disposed standing on edge generally in end-to-end horizontally extending relationship with the mutually adjacent ends of such pack sections spaced apart slightly, said means including a generally horizontal base, reference surface means mounted on said base in upstanding position thereon to be contacted by one side only of the pack sections, thereby to maintain such sections in upright position overlying said base, underlying support means on said base having portions respectively supporting such pack sections by the lower edges of the cards at relatively spaced locations removed from the mutually adjacent ends of the pack sections, additional reference surface means upstanding from said base and respectively contacted by the relatively opposite ends of the pack sections in outwardly inclined positions determined by the tilt of the sections, said additional reference surface means being relatively spaced apart to establish said slight initial spacing between the mutually adjacent ends of such pack sections, retractable ledge means mounted on said base in generally horizontally extending position to supportingly contact the lower edges of the respective pack sections near the mutually adjacent ends thereof, means operatively connected to said ledge means to retract the same progressively from beneath the card pack sections in the direction tending to compress the cards against the first-mentioned reference surface means, thereby permitting the cards to drop by gravity off the ledge means and fulcrum about said respective underlying support means in generally random fashion from the respective pack sections and into overlapping intermixed relationship of such cards, and means on said base extending generally parallel to the line of retraction of said ledge means and disposed therebeneath to catch the dropping cards and support the same in such overlapping relationship, said latter means being spaced a distance below said ledge means such that the cards remain in such overlapping relationship with the outer ends thereof remaining in said underlying support means.

8. A card shuffler comprising means to support a pack of cards divided into two sections disposed standing on edge generally in end-to-end horizontally extending relationship with the mutually adjacent ends of such pack sections tilted upwardly and spaced apart slightly, said means including a generally horizontal base, reference surface means mounted on said base in upstanding position thereon to be contacted by one side only of the pack sections, thereby to maintain such sections in upright position overlying said base, underlying support means on said base having portions respectively supporting such pack sections by the lower edges of the cards at relatively spaced locations removed from the mutually adjacent ends of the pack sections, additional reference surface means upstanding from said base and respectively contacted by the relatively opposite ends of the pack sections, said additional reference surface means being relatively spaced apart to establish said slight initial spacing between the mutually adjacent ends of such pack sections, retractable ledge means mounted on said base in generally horizontally extending position to supportingly contact the lower edges of the respective pack sections near the mutually adjacent ends thereof, said ledge means being elevated relative to said base portions to support such pack sections in said upwardly tilted position, means operatively connected to said ledge means to retract the same progressively from beneath the card pack sections in the direction tending to compress the upwardly tilted cards against the first-mentioned reference surface means,

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thereby permitting the cards to drop by gravity off the ledge means in generally random fashion from the respective pack sections and into overlapping intermixed relationship of such cards, and means on said base extending generally parallel to the line of retraction of said ledge means and disposed therebeneath to catch the dropping cards and support the same in such overlapping relationship, said latter means being spaced a distance below said ledge means such that the cards remain in such overlapping relationship with the outer ends thereof remaining on said underlying support means.

9. The card shuffler defined in claim 8, wherein the ledge means comprises a member having laterally outwardly declining ledge sides supportingly contacting the respective pack sections and having end edges forming an acute angle with longitudinally extending outer side edges of such member, whereby during progressive retraction of said ledge member from beneath the supported cards such cards drop successively off the respective end corners of said sides.

10. The card shuffler defined in claim 9, wherein the first-mentioned reference surface means comprises a pair of upright gauge members disposed in planes forming an included dihedral angle therebetween, diverging in a direction generally oppositely from the direction of retraction of the ledge means, and wherein the last-mentioned means disposed on the base to catch the dropping cards comprises conveyor means operable to convey the dropped cards in a direction swinging such cards from dihedral angular relationship toward generally parallel relationship, and end rack means positioned above the base at a location permitting the dropped cards standing on edge on said conveyor means to lean against said end rack means for support.

11. The card shuffler defined in claim 10, wherein the end rack means is supported and guided for translational movement in the direction of advance of the cards on the conveyor means, and means connecting said end rack means to the ledge-retracting means for retracting said end rack means simultaneously with retraction of the ledge means.

12. The card shuffler defined in claim 11, wherein the underlying support means comprise elements connected to the end rack means for retraction of such elements conjointly therewith, and means drivingly connected to the ledge means, the end rack means and the conveyor means for operating said conveyor means to advance the mutually adjacent ends of the dropped cards at a nominal rate materially faster than the rate of retraction of the end rack means, whereby the cards are swung progressively into greater overlapping relationship, toward generally coplanar alignment, and are simultaneously shifted bodily away from the remaining cards still supported by the ledge means.

13. A card shuffler comprising holder means to support a pack of cards divided into two sections, disposed standing on edge generally in end-to-end horizontally extended relationship with the mutually adjacent ends of such pack sections spaced apart slightly and with initial angularity between the general planes of the pack sections, said support means including generally horizontal ledge means disposed in supporting contact with the cards solely near mutually adjacent ends of said pack sections, and means effecting relative movement between said ledge means and the holder means and cards in said holder means transversely to the card pack sections to permit dropping of said cards successively off said ledge means in generally random alternate fashion from the pack sections, whereby mutually adjacent end portions of such cards swing downward and into overlapping intermixed relationship of mutually adjacent end portions of the cards in the two sections, conveyor means disposed a predetermined distance below said relatively movable ledge means to catch the dropping cards and maintain them in overlapping relationship and upright on edge, and means effecting movement of the conveyor

means relative to the holder means in the direction opposite movement of the ledge means, thereby to convey the dropping cards away from those in the holder means to make room for succeeding cards to drop.

14. The card shuffler defined in claim 13, wherein the two means effecting relative movement comprise means operable to effect progressive retraction of said ledge member and further operable to effect simultaneous operation of the conveyor means therewith.

15. The card shuffler defined in claim 14, wherein the conveyor means includes retractable end rack means

formed and positioned for supporting the cards on edge on the conveyor means, and means driving interconnecting said end rack means and the retractable ledge means to effect simultaneous relatively opposite movements of said end rack means and said ledge means.

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