United States Patent

[11] **3,584,742**

[72] Inventor **LeRoy E. Gerlach**
Minneapolis, Minn.

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[73] Assignee **Sperry Rand Corporation**
New York, N.Y.

[54] **CARD PROFILE COMPENSATION FOR REMOVABLE CARD-HANDLING CARTRIDGE**
10 Claims, 6 Drawing Figs.

[52] U.S. Cl. **209/80.5**, 271/86
[51] Int. Cl. **B07c 3/10**
[50] Field of Search 209/80.5, 110.5; 271/86

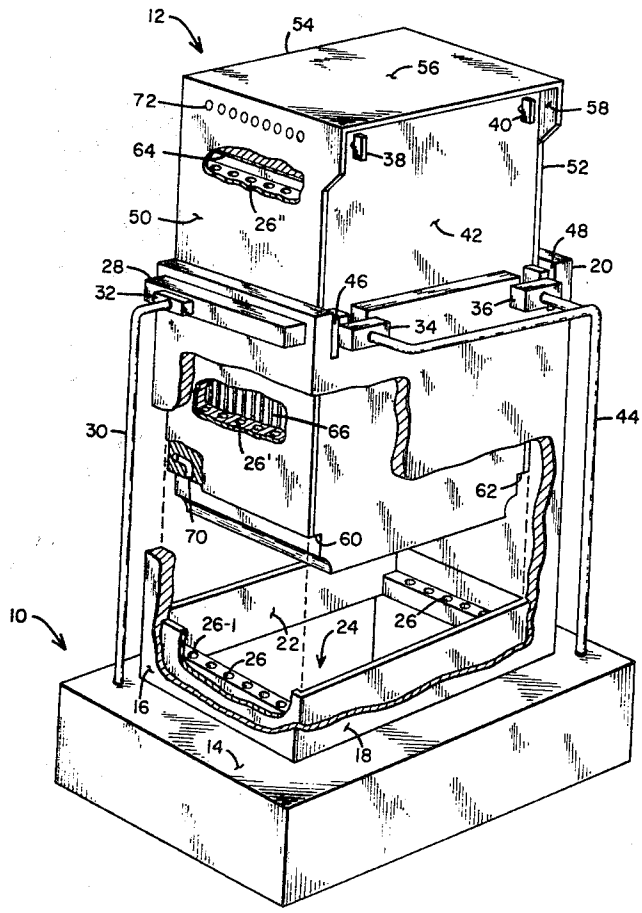
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Primary Examiner—Allen N. Knowles
Attorneys—Thomas J. Nikolai, Kenneth T. Grace and John P. Dority

ABSTRACT: A removable card-handling cartridge for retaining a plurality of cards in a side-by-side relationship for use by a card-handling apparatus is described. Included in the removable cartridge, are a plurality of end-coded cards retained by a plurality of selectively actuatable card-retaining pins, the pins being coded and selectively actuatable for permitting the selection of individual ones of the end-coded retained cards for access to the card-retained cards for access to the card-handling apparatus. High-resistance fluid nozzles are utilized for keeping the cards separated while in the retained position. An end wall fluid system is also shown for providing card profile compensation for ensuring card separation. Additionally, a fluid system is illustrated for assisting in returning cards to the cartridge.



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SHEET 1 OF 2

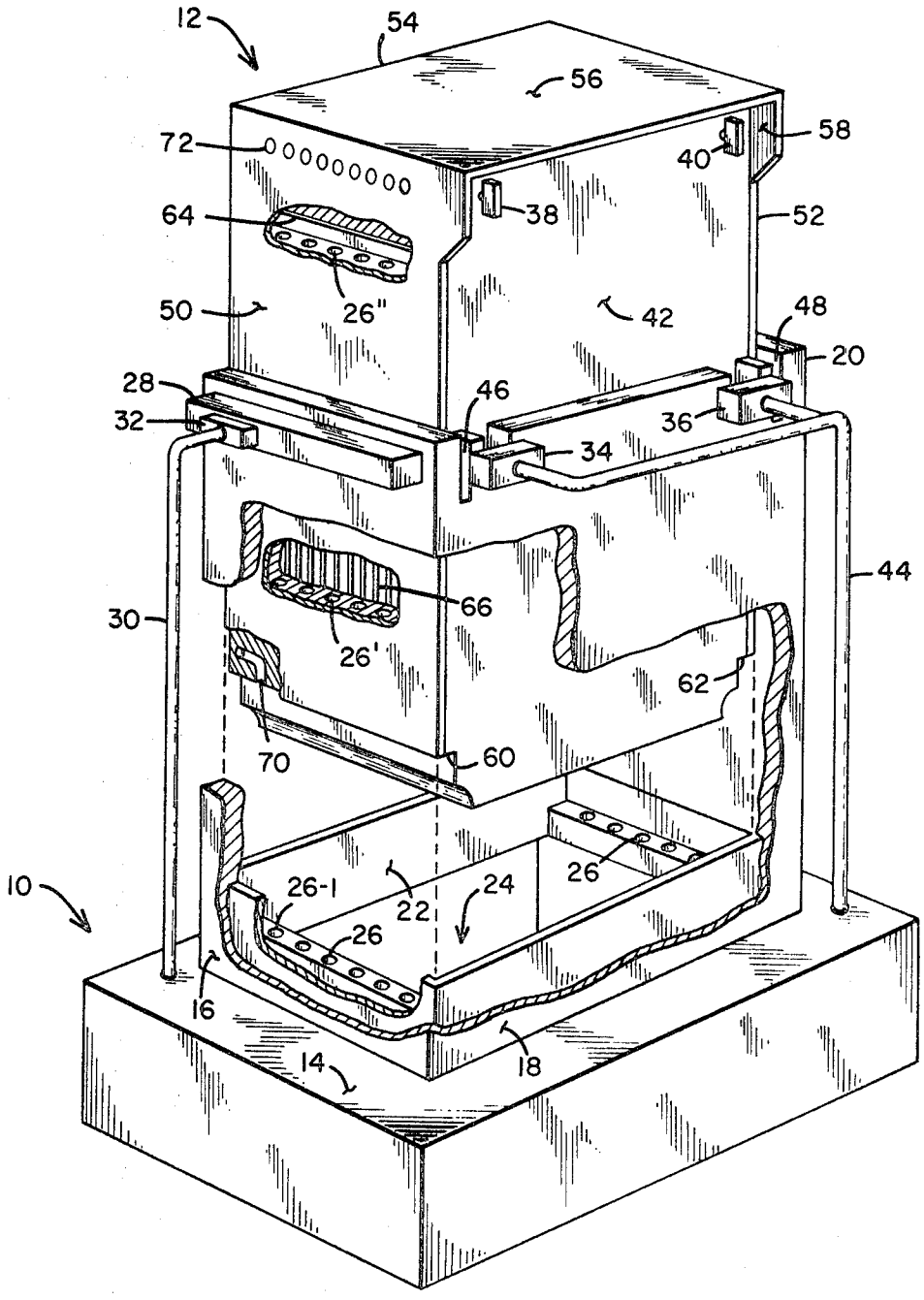


Fig. 1

INVENTOR
LEROY E. GERLACH
BY Charles A. Johnson
ATTORNEY

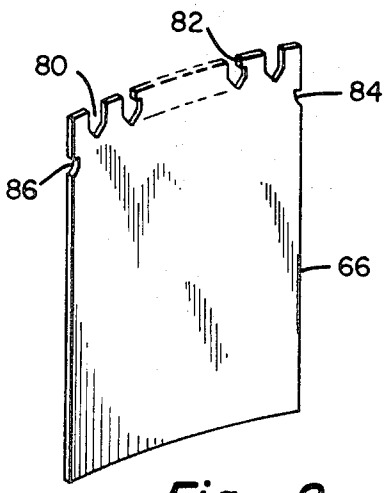


Fig. 2

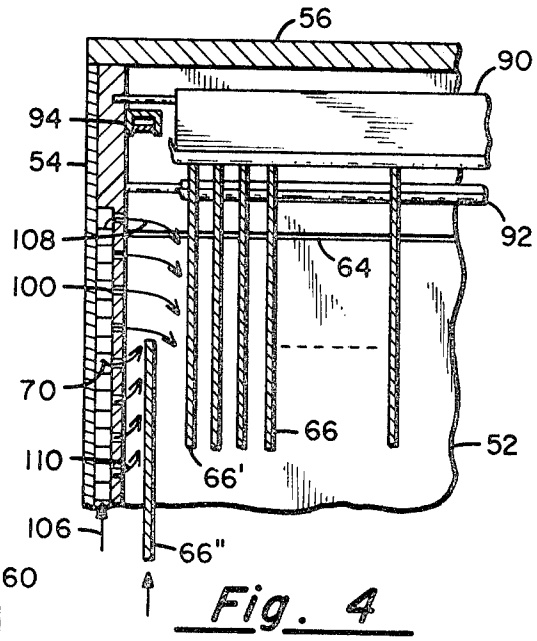


Fig. 4

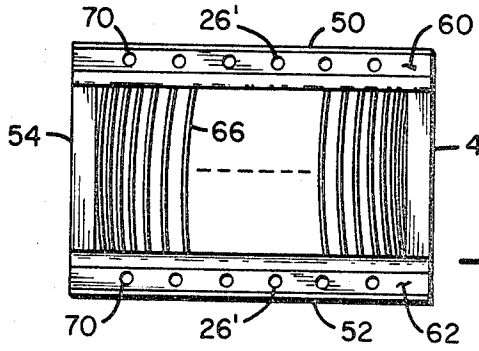


Fig. 3

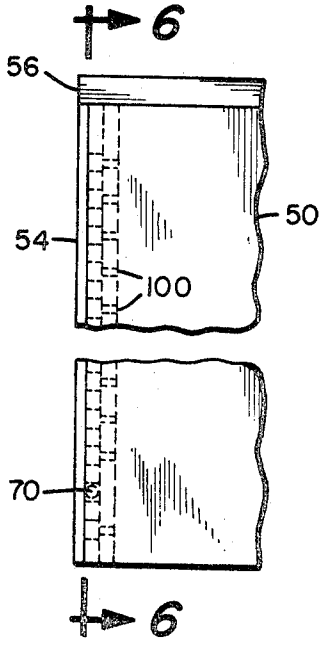


Fig. 5

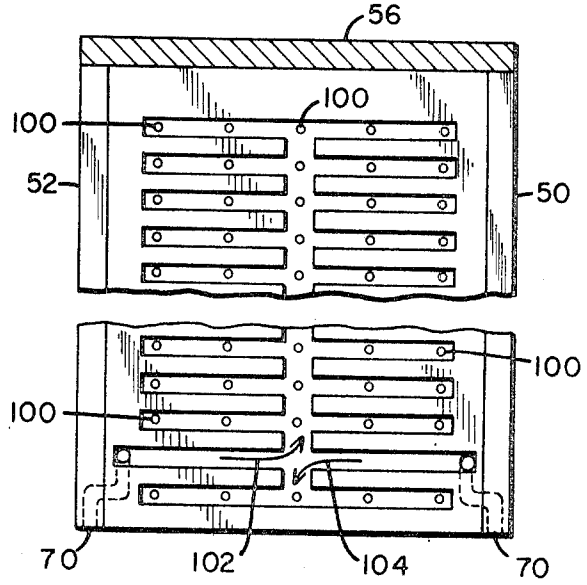


Fig. 6

CARD PROFILE COMPENSATION FOR REMOVABLE CARD-HANDLING CARTRIDGE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention pertains generally to the field of card-handling apparatus. More specifically, it relates to the field of card-handling apparatus. More specifically, it relates to the field of card-handling apparatus wherein a plurality of cards are retained in a removable cartridge for individual selection and use by the card-handling apparatus, with the individual card subsequently being returned to the cartridge. Still more specifically, this invention relates to the field of removable card-handling cartridges having improved means for keeping the retained cards separated, and for providing card profile compensation for aiding in the separation and return of the cards.

2. Description of the Prior Art

There are known in the prior art, random access information storage systems which are adapted to handle information, or data, recorded by magnetic techniques on strips of flexible material, referred to as cards. The cards are each provided with various forms of suspension (card-retaining) end-coded arrangements for suspending the cards in a container, or cartridge, where they are capable of being selectively released one at a time into the card-handling apparatus. Characteristically, the various types of card-handling apparatus have various devices for transporting the cards through a transducing regions for cooperation with reading and recording transducers. Various devices and arrangements are known for returning the cards to the retained position.

Many prior art devices have also recognized the desirability of maintaining the cards out of contact with one another to minimize the wear on the recording surface of the cards due to abrasion that might be encountered when a selected card is caused to slide past the adjacent card during the selection process. Problems encountered in prior devices reside in the inability of prior art separation systems to ensure that all the cards will be separated. Problems in individual cards failing to separate, result from frictional contact between cards and card-retaining pins, and frictional contact between individual cards that are located at the ends of the stack and the end walls of the container.

Having recognized the desirability of maintaining the cards in a separated condition, an early from of separation apparatus utilized the injection of a stream of air downwardly against the tops of the retained cards. The air forced on to the tops of the cards tended to increase the problem of the frictional engagement of the supporting notches of the cards with the card-retaining pins, thereby tending to enhance the problem of separation of the cards rather than completely solve the problem. Further, due to the nature of the devices for injecting the airflow, problems of fluid pressure balance exists in the prior art, and flutter is induced in the cards due to such unbalanced fluid flow. An improvement over the prior art device just described, was the recognition that high resistance fluid nozzles placed at the sides of the suspended cards would tend to separate the cards without imparting flutter thereto. Nozzles of this type are disclosed in the copending U.S. Pat. application of LeRoy E. Gerlach, et al. entitled REMOVABLE CARD-HANDLING CARTRIDGE, Filed May 29, 1969, Ser. No. 828,858 otherwise identified as ERA–1824, and assigned to the Assignee of the instant invention. The nozzle arrangement disclosed therein solves the problem of card separation for a major portion of the stack of cards, but in some instances, fails to provide the appropriate card separation for a major portion of the stack of cards, but in some instances, fails to provide the appropriate card separation at the end walls of the card-handling cartridge. Failure of the nozzles to separate in this area, is attributed to the fact that the cards are not strictly flat, but may have a curved profile tending to cause the cards to bunch at the ends of the stack.

Other nozzle arrangements are shown in the copending U.S. Pat. application of LeRoy A. Vos, entitled HIGH RESISTANCE NOZZLE AND DOCUMENTS SEPARATOR, filed Jan. 15, 1969, Ser. No. 791,263, and the invention of Gordon P. Johnson, et al., entitled NOZZLE AND CONTROL APPARATUS, filed Jan. 15, 1969, Ser. No. 791,239, both of these applications being assigned to the assignee of the instant invention.

Closely associated with the card separation problem referred to in the above identified application of LeRoy E. Gerlach, et al., is the problem of returning cards at a predetermined card-return end of the card-handling cartridge. It has been noted that in those situation s wherein cards having a curved profile are utilized, with the attendant tendency to bunch at the end walls, that returning cards have a tendancy to impinge on these bunched cards with the result that intermittently, cards failed to return to the cartridge properly. It is to the foregoing problems and disadvantages in the prior art that the subject invention is directed.

SUMMARY

In summary, then, this invention comprises an improved removable card-handling cartridge having a plurality of card-retaining pins for cooperating with a plurality of end-coded cards arranged in a side-by-side relationship in the cartridge, and having high resistance fluid nozzle means arranged at the sides of the cartridge for directing fluid flow at the edges of the supported cards for maintaining the cards in a separated condition without imparting flutter thereto, together with fluidic card profile compensation means for assisting in the separation of the cards in the vicinity of the end walls and for further assisting in the return of cards to the cartridge.

A primary object of this invention, then, is to provide an improved removable card-handling cartridge for use with a card-handling apparatus wherein improved card profile compensation is achieved. Another object of this invention is to provide an improved removable cartridge having a plurality of end-coded cards arranged in a side-by-side relation on selectively actuatable card-retaining and selection pins, having card profile compensation apparatus for ensuring separation of cards at the ends of the stack. A further object of this invention is to provide an improved cartridge having a fluidic card profile compensation system for ensuring separation of cards at the ends of the stack. Still a further object of this invention is to provide an improved cartridge having means for assisting in the positioning of supported cards for aiding the return of cards at the ends of the stack. Yet a further object of this invention is to provide an improved removable cartridge having fluidic card profile correction apparatus for aiding in return of cards to the card-return end of the stack, the improved cartridge having a minimum of connections to the card-handling apparatus. These and other more detailed and specific objective will become apparent to those skilled in the art from a consideration of the accompanying drawings when viewed in light of the following detailed description of the preferred embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of an improved removable cartridge partially inserted in a card-handling apparatus, with portions to the cartridge and card-handling apparatus broken away for ease of illustrating the invention; FIG. 2 is a perspective view of an end-coded card capable of being utilized in the improved removable cartridge, and illustrates the curved profile of the card; FIG. 3 is a bottom view of a removable cartridge, illustrating the location of the supported cards within the cartridge, and further illustrating the bunching of the cards due to the profile variations at the ends of the cartridge; FIG. 4 is a partial sectional view of the improved removable cartridge of this invention, and illustrates the fluidic card profile compensation apparatus as it acts on the fluidic card profile compensation apparatus as it acts on the retained cards for forcing

them away from the card-return end wall, and as it provides a fluid bearing for assisting in the return of the cards to the stack; FIG. 5 is a side view of the end wall that incorporates the card profile compensation apparatus; and FIG. 6 is a cross-sectional view taken along lines 6–6 in FIG. 5 and illustrates the fluidic passageway and aperture system arrangement for the card profile compensation apparatus.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1 there is shown a perspective view of a card-handling apparatus 10 and a partially inserted removable cartridge 12, the cartridge having many of the elements of the above identified Gerlach, et al., application. The card-handling apparatus 10 includes a supporting member 14 for mounting supporting walls 16, 18, and 20. Portions of walls 16 and 18 are broken away to illustrate the lower portion of cartridge 12, and to illustrate the support housing 22. The inner portion of support housing 22 is an opening indicated by arrow 24, which extends into the card-handling apparatus 10, for access to transducing apparatus (not shown) for reading and recording on cards, and apparatus (not shown) for positioning and handling the cards during the time they are removed from the card-handling cartridge 12. Card-handling apparatus 10 also includes a source of pressurized fluid (not shown) that is coupled to ports 26 in the sides of housing 22 for directing the pressurized fluid upwardly. Ports 26 are directed upwardly for cooperating with like arranged ports in the cartridge 12. In the embodiment shown, there are six ports 26 at each side of housing 22. Five of the ports 26 are utilized for supplying air for separating the cards, as will be described in more detail below, and one port at each side is utilized for supplying fluid to the card profile compensation apparatus of this invention. The latter ports are the endmost ports on each side.

Wall 16 mounts retaining-pin selection apparatus within housing 28. Characteristically, these pin actuators are electrical relays. Alternatively, the retaining-pin actuators 28 could be selected from those systems described in copending U.S. Pat. application of David A. Tandeski, entitled RETAINING PIN AND ACTUATION APPARATUS, Ser. No. 828,821, filed May 29, 1969, otherwise identified as ERA–1790, and assigned to the Assignee of this invention. When electrical solenoids are utilized, the card-handling apparatus 10 includes electronic circuitry (not shown) for providing the selection signals through cable 30, which in turn is coupled through plug 32, to the retaining-pin selection housing 28, for actuating the selected ones of the card-retaining and selection pins in the removable cartridge 12. The interrelationship between the electrical solenoids, and the ends of the card-retaining and selection pins within cartridge 12, can be similar to that described in the above identified application of LeRoy E. Gerlach, et al.

Wall 18 is utilized for mounting the gating-rod actuation mechanisms in housings 34 and 36. Portions of the gating-rod actuation mechanisms (not shown) cooperate with gating-rod drive elements 38 and 40 mounted in the front wall 42 of cartridge 12. The card-handling apparatus also includes electrical circuitry (not shown) for providing activation signals over conductors included in cable 44 to each of the housings 34 and 36. The gating-rod actuation system is similar to that described in the above identified Gerlach et al. application. In addition to supporting housings 34 and 36, wall 18 has a pair of slots 46 and 48 for receiving portions of the cartridge 12.

In addition to front wall 42, the cartridge 12 includes sidewalls 50 and 52, and end wall 54. A top 56 joins all four walls together. A protective housing 58 extends outwardly from the front wall 42 for protecting the gating-rod actuators 38 and 40. The sidewalls 50 and 52 are terminated at the lower ends in supporting surfaces 60 and 62 respectively which are arranged for cooperation with the upper surfaces of that portion of the housing 22 where fluid ports 26 are opened. Each of the sidewalls 50 and 52 have fluid conduits therein for cooperating with ports 26. For instance, in sidewall 50 there is shown a broken away portion with five conduits 26′ for carrying pressurized fluid upwardly through wall 50 where the fluid is exhausted through openings 26″ in the high resistance fluid nozzle chamber. The high resistance fluid nozzle chamber opens into the inner part of cartridge 12 through nozzle slot 64, and provides the forces utilized for separating the cards 66.

In this invention, an additional port 26–1 is arranged for cooperating with fluid conduit 70 for carrying fluid from the sidewall to the end wall 54, as will be described in more detail below. It is this conduit 70 that provides the pressurized fluid flow upwardly in the backwall 54 for providing the card-profile compensation. A fluid conduit similar to conduits 70 is arranged for cooperating with the endmost port 26 at side 52.

A plurality of openings 72 provide access to the actuation ends of the apparatus utilized for actuating the card-retaining and selection pins within cartridge 12. These openings 72 are arranged for cooperation with the actuation devices enclosed within housing 28 when the cartridge 12 is fully inserted into the card-handling apparatus 10.

In the foregoing arrangement, card-handling cartridge 12 can be inserted and removed from the card-handling apparatus 10 without having to disconnect any operative portion of the system. It can be seen that the cards 66 are spaced apart and arranged in the side-by-side manner with the edges facing sidewalls 50 and 52. When released by the appropriate combination of signals in cables 30 and 44, the selected card will pass downwardly for use by the card-handling apparatus 10. The handling of the card 66 within the card-handling apparatus does not from a part of this invention and will not be described in any further detail, it being clearly understood that means are provided for taking the card from card-handling cartridge 12 at any location selected within the stack and returning the card at the end wall 54 of cartridge 12.

FIG. 2 illustrates a characteristic end-coded card 66 of the type contemplated for usage with this invention. Characteristically, the cards 66 are comprised of a flexible plasticlike material, such as "Mylar" a trademarked product of E. I. du-Pont de NeMours and Company, with a magnetic layer deposited thereon. The card 66 has the physical characteristics of a width of 4.5 inches; length of 14.0 inches; and thickness of approximately 0.0054 inch. While the number of cards 66 that can be accommodated by cartridge 12 will vary, it is contemplated that an advantageous system would include 512 individually addressable cards. To accommodate their addressing, there would be required nine notches in the end-coded portion. Certain of the notches 80 have straight sides, thereby giving no support to card 66, while others of the notches 82 have tab portions for supporting the card 66 on respectively associated card-retaining and selection pins. The various cards 66 in the stack will have different combinations of notches having supporting tabs, thereby rendering the end-coded portions of the stack of cards individually addressable. The tab portions are illustrated at the right side of the notches for a 2-position selection system but it should be understood that tabs can alternatively at the left, or at either side for a 3-position selection system. At the edges of cards 66 are gating-rod notches 84 and 86. It will be noted that the card 66 is bowed. This is a physical condition that is generated in the card during a manufacturing process, and the bowing may be in either the rearward direction, as shown, or forward directions. Further, different batches of cards may have different degrees of profile bowing. It is this bowing that tends to create problems in separation of the cards at the ends of the stack, and creates further problems with regard to retaining cards at the card-return end wall 54 of the cartridge.

In FIG. 3 there is shown a bottom view of a cartridge with a plurality of cards 66 therein. There is shown the front wall 42, and the card-return wall 54, together with the sidewalls 50 and 52. The fluid-carrying conduits 26′ are shown opening at the bottom of walls 50 and 52, and the conduits 70 are also shown

opening at the bottom of walls 50 and 52. Due to the bowing of the cards 66, as described above, it can be seen that the concentration of cards in the proximity of wall 42 and card-return end wall 54 is greater than throughout the remainder of the stack. The bowing of the cards causes frictional engagement of the walls 42 and 54, as well as frictional engagement with next adjacent cards. This arrangement cannot adequately be handled by the fluid nozzle arrangement utilized for separating the cards, due the proximity to the ends of the cartridge. Without profile compensation for the cards, it can be seen that cards trying to return at the card-return end wall 54 would impinge on the lower edge of the cards next adjacent to the end wall 54 and would be prevented from sliding upwardly into the cartridge for engaging the card-retaining pins. Further, it can be seen that this bunching of cards with the frictional contact between adjacent cards materially impedes the selection of cards from the bunched groupings.

A consideration of the FIGS. 4, 5, and 6 will provide an understanding of the structure that is utilized to compensate for the bowed profile of the cards. In FIG. 4 there is shown a partial sectional view of the improved cartridge of this invention, and illustrates a portion of a card retaining and selection pin 90, together with the actuation arrangement, of the type described in the above-identified Tandeski copending application. There is also shown a portion of one of the gating rods 92 and the fluid nozzle 64, previously mentioned. The cards 66 are shown as having a flat profile, it being understood that an actuality they would have the curved profile shown in FIG. 3. A card brake 94 is arranged for bringing returning cards 66'' to a stop for being engaged by the card-retaining pins 90 and gating rods 92. A characteristic card brake can be chosen from those in the prior art, but most advantageously will be the type of momentum-transfer card brake illustrated and described in another copending U.S. application of LeRoy E. Gerlach et al., entitled MOMENTUM-TRANSFER CARD BRAKE, filed May 29, 1969 Ser. No. 828,861, otherwise identified as ERA-1836, and assigned to the assignee of the instant invention.

Referring briefly to the FIG. 5, there is shown a side view of card-return end wall 54. A plurality of apertures 100 are arranged for exhausting pressurized fluid into the cartridge chamber.

In FIG. 6 there is shown a sectional view taken along line 6–6 in FIG. 5, that illustrates the conduit paths 70 in sidewalls 50 and 52, for directing the pressurized fluid into the chambers where there is fluid communication with a coordinate array of apertures 100. Fluid flows upwardly through conduit 70 and flows in the directions of arrows 102 upwardly, and 104 downwardly. As the fluid is continually forced upward through conduits 70, there is a pressure buildup throughout the entire chamber area, and fluid is exhausted through apertures 100 into the inner portion of the cartridge. Characteristically, the apertures are approximately 0.020 inch for this embodiment.

Returning again to a consideration of FIG. 4, the operation of the device just described can be clearly seen. The fluid is flowing in the direction to arrow 106 in the chamber area 70, and at the uppermost four apertures 100, tends to be directed outwardly and downwardly, as illustrated by arrows 108. In the absence of returning card 66'', all of the fluid exhausted through apertures 100 would tend to bear on the surface of the endmost card 66', tending to force it away from endwall 54. Once the fluid within the cartridge had reached a predetermined pressure in the upper portion, the fluid would tend to flow outwardly and downwardly where it would be exhausted in the card-handling apparatus 10. It can be seen therefore, that by providing the fluid flow over the entire face of the endmost card 66', that the frictional contact with the inner portion of end wall 54 is eliminated, and the cards are tended to be forced in the direction of front wall 42. As cards are selected, it is necessary that the stack be adjusted toward wall 42 in order to provide space at the card-return end wall 54 for the return of the card. As the cards are moved toward wall 42 the full operation of the separating fluid nozzle 64 is brought into play and the bunching of the cards at the card-return end wall 54 is eliminated. The pressurized fluid in chamber 70 also provides a laminar flow of fluid, as indicated by arrows 110 directed upwardly, wherein the pressurized fluid engages the surface of the returning card 66'' and holds it out of contact with the card-return end wall 54. Since the returning card does not contact the wall, and since the endmost cards 66' has been moved away from wall 54, there is adequate space for the returning card to return into the cartridge, where it is stopped by card brake 94 and reengaged on the retaining-pins 90 and the gating rods 92.

An arrangement similar to that illustrated in FIGS. 4, 5, and 6 can be utilized in the front wall 42, also for compensating for bunching of the cards. In the event other apparatus, such as a card-retaining apparatus, must be mounted in front wall 42, however, the problem of bunching of the cards in the vicinity of that wall can be overcome by the insertion of a predetermined number of dummy cards that will never be selected. Characteristically, the number of dummy cards can be in the order of four to six, with the appropriate separation of addressable cards, proceeding into the stack from the dummy cards, being adequately handled by the separation nozzle 64.

The fluid pressure supplied to conduit 70 can be in the range of approximately 4 pounds per square inch, and the pressure exhausted through apertures 100 can characteristically be in the arrange of approximately 2 pounds per square inch.

It can be seen from the foregoing detailed description of the preferred embodiment, that the various general and specific objectives of the invention have been achieved, and are fully illustrated herein. It being recognized that various changes in dimensions, arrangements, and configurations will become apparent to those skilled in the art without departing from the spirit and scope of the invention, what is intended to be protected by Letters Patent is set forth in the appended claims.

I claim:

1. For use in a card cartridge having a plurality of card-retaining pins for cooperating with a plurality of end-coded cards arranged in a side-by-side relationship in the cartridge, and having fluid nozzles arranged at the sides of the cartridge for directing fluid flow at the end of the cards for maintaining the cards in a separated condition, and having a pair of sidewall members, a front wall member, and an end wall member, card profile compensation apparatus comprising: said end wall member having a plurality of fluid-exhaust apertures in fluid communication with the interior of the cartridge, fluid source means for providing fluid flow through said apertures bearing on the face of the end card next adjacent said end wall member for holding said end card out of contact with said end wall member at all times and at a distance sufficient to enable another card to be inserted between said end wall member and said end card, and with a spacing being maintained between said other card and said end wall member and also between said other card and said end card; and fluid conduit means for coupling to a source of pressurized fluid, said fluid conduit means being in fluid communication with said plurality of fluid-exhaust apertures.

2. Card profile compensation apparatus as in claim 1 wherein said fluid conduit means includes fluid input means downwardly extending in said end wall member and opening at the bottom of said sidewall member for fluid communication with fluid supply ports in the associated card-handling apparatus, and a plurality of transverse channels extending upwardly along said end wall member, respective ones of said plurality of exhaust ports located in associated ones of said channels.

3. Card profile compensation apparatus as in claim 2 and further including a predetermined number of dummy cards retained in side-by-side relationship adjacent said front wall member, said dummy cards normally being unselectable and arranged for spacing selectable ones of said cards outwardly from said front wall member, thereby rendering the selectable cards readily separatable by the fluid nozzles.

4. Card profile compensation apparatus as in claim 2 wherein said plurality of fluid-exhaust apertures are arranged in a coordinate array extending over substantially all of the surface of said face of said end card for providing substantially uniform loading on said card.

5. Card profile compensation apparatus as in claim 4 wherein said end wall member is in the card-return area for returning cards, said fluid exhausted forming a fluid bearing for keeping said returning cards out of contact with end wall member.

6. For use in card-handling apparatus, and improved cartridge including in combination: a pair of parallelly arranged spaced-apart sidewall members; a front wall member joined intermediate said sidewall members; and endwall member generally parallel to said front wall member and joined intermediate said sidewall members; a top member joined to said sidewall members, said front wall member, and said end wall member for closing the top of the cartridge; a plurality of selectively actuatable card-retaining and selection pin means for supporting a plurality of end-coded cards, said pin means mounted between said front wall member and said end wall member; fluid nozzle means mounted in said sidewall members for directing fluid flow at the edges of the retained cards for maintaining the cards in spaced-apart positions; said end-wall member including a plurality of fluid-exhaust apertures in fluid communication with the interior of the cartridge, fluid source means for providing fluid flow through said apertures bearing on the face of the end card next adjacent said end wall member for holding said end card out of contact with said end wall member at all times and at a distance sufficient to enable another card to be inserted between said end wall member and said next adjacent end card, and with a spacing being maintained between said other card and said end wall member and also between said other card and said end card, and fluid conduit means for coupling to a source of pressurized fluid from the card-handling apparatus, said fluid conduit means in fluid communication with said plurality of fluid-exhaust apertures.

7. The cartridge as in claim 6 wherein said fluid conduit means includes fluid input means downwardly extending in said end wall member and opening at the bottom of the sidewall members for fluid communication with fluid supply ports in the card-handling apparatus, and a plurality of transverse channels extending upwardly along said end wall member, respective ones of said plurality of fluid-exhaust apertures located in associated ones of said channels.

8. The cartridge as in claim 7 and further including a predetermined number of dummy cards retained in a side-by-side relationship adjacent said front wall member, said dummy cards normally being unselectable and arranged for spacing selectable ones of the cards outwardly from said front wall member, thereby rending said selectable cards readily separatable by said fluid nozzle means.

9. The cartridge as in claim 7 wherein said plurality of fluid-exhaust apertures are arranged in a coordinate array extending over substantially all of the surface of said face of said end card for providing substantially uniform loading on said card.

10. The cartridge as in claim 9 wherein said end wall member is on the card-return area for returning cards, said fluid exhausted through said plurality of fluid-exhaust apertures forming a fluid bearing for keeping said returning cards out of contact with said end wall member.

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,584,742 Dated June 15, 1971

Inventor(s) Le Roy E. Gerlach

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 7, line 8, after "exhausted" insert -- through said plurality of fluid-exhaust apertures --. Column 8, line 27, "on" should read -- in --.

Signed and sealed this 23rd day of May 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334