ABSTRACT OF THE DISCLOSURE

A deceleration plate including gradually and sharply curved sections functions to decelerate the cards prior to contacting a stop and fan roll and to control the location of storage of potential energy in the cards whereby the cards snap or eject away from the deceleration plate after the leading end of the cards strikes a stop and fan roll. A deflector which forms an entry throat with the deceleration plate deflects the trailing edge of the cards toward a stacking platform as the cards snap away from the deceleration plate.

Background of the invention

(1) The invention relates to apparatus for stacking documents such as record cards and more particularly to record card stacking apparatus where the cards are decelerated prior to being stopped within the stacker and still more particularly to stacking apparatus which controls the location of the storage of potential energy in the cards and thereby the release characteristics of the cards away from a guiding surface after impact with a stop member.

(2) Description of the prior art.—Heretofore, card or document stackers did not have the ability to stack cards at extremely high speeds without damage to the leading edge of the cards. Further, these document stackers do not have the ability to stack cards at extremely high speeds without the leading edge of an oncoming card colliding with the trailing portion of the card dropping onto a stacking platform. Moreover, prior art stackers which do decelerate the cards before bringing them to rest are relatively complex and expensive. Previous stackers do not operate properly over a wide range of card rates and particularly where the rates vary randomly.

Summary

The invention permits cards to be stacked in an ordered sequence at relatively high speeds. The cards will be properly stacked, i.e., in order and without card jams, even if feeding takes place at random rates. The cards are decelerated to reduce impact forces on the leading edge of the cards. A card guiding surface is configured to effect deceleration in a short distance and to localize high potential energy in the cards whereby upon the card being stopped converts to kinetic energy to eject the card away from the guiding surface and out of the path of an oncoming card. The apparatus for decelerating the card and providing localized high potential energy is quite simple in construction and therefore is relatively inexpensive.

Brief description of the drawings

FIG. 1 is a front elevational view of the apparatus embodying the invention for stacking cards horizontally;

FIG. 2a is a view illustrating the relative positions of a first card within the stacker and a second card about to enter the stacker;

FIG. 2b is a view similar to FIG. 2a and shows the first card deflected and moving away from the deceleration plate, the second card has moved closer to the entry point of the stacker;

FIG. 2c is similar to FIGS. 2a and 2b and shows the second card entered into the stacker whereby the trailing edge of the first card is deflected further toward the stacking platform;

FIG. 3 is a view illustrating relative positions of several cards in the stacker; and

FIG. 4 is a front elevational view of the apparatus embodying the invention for stacking cards vertically.

Detailed description

With reference to the drawings, and particularly to FIG. 1, the invention is illustrated by way of example as being incorporated into a record card machine which includes a pair of cooperating feed rollers 10 and 11 for feeding a document along a document path and into a throat formed by deflector 12 and deceleration plate 13. Since this invention is concerned only with the apparatus for stacking the cards, the other portions of the machine are not shown.

The deflector 12, in this example, is a piece of spring steel suitably attached at one end to a support member 19 by a rivet 18. The other end of deflector 12 resides in a small, V-shaped notch 16 formed in the deceleration plate 13. The deceleration plate 13 includes a section 14 which has a relatively large radius of curvature and a section 15 which has a relatively small radius of curvature. The width of deflector 12 and deceleration plate 13 are substantially the same and equal to the width of a record card. The deceleration plate 13 is attached at a right angle to plate 20.

Section 15 which is integral with section 14 to form deceleration plate 13 joins section 14 along a line which is substantially in registration with and parallel to the leading edge of card 5 as the trailing edge leaves the nip formed between feed rollers 10 and 11 as seen in FIG. 1. Thus, card 5 is in free flight as it follows the inner peripheral surface of curved section 15 under centripetal acceleration. Centripetal acceleration produces a high normal force between section 15 and the card. This high normal force increases the friction between the card and section 15 so as to decelerate the card. Some of the kinetic energy is transformed into heat and another portion is stored in the curved portion of the card as potential energy. The amount of deceleration can be controlled through the selection of the coefficient of friction of the material for section 15 and by its radius of curvature. In this example, deceleration plate 13 is made of steel.

A stop member 21 which, in this example, is a stop and fan roll, is located at the end of the curved section 15. Roll 21 is substantially the width of the card and is rotated in a clockwise direction by a suitable driving mechanism schematically illustrated as drive 22. The stop and fan roll 21 is preferably made from resilient material such as thirty durometer rubber. The leading edge of the cards must not be marked or damaged as they come against the stop and fan roll 21. The stop and fan roll 21 is slightly deflected or compressed when impacted by the leading edge of a card.

When the leading edge of a card strikes the stop and fan roll 21, the trailing edge of the card has just passed the tip of deflector 12 as seen in FIG. 2a. The combined energy stored in the leading portion of the card and in the compressed stop and fan roll moves the trailing portion of the card against deflector 12 and then away from the surface of section 14. The leading portion of the card also under the action of the energy released from the card moves away from the surface of section 15 as the trailing portion moves down along the surface of deflector 12, as seen in FIG. 2b. As the trailing edge continues its downward motion along deflector 12, a second card is fed by feed rollers 10 and 11 to move deflector 12 out of slot 16. This action further deflects the trailing
portion of the first card and keeps it out of the path of the incoming second card. The trailing portion of the card eventually drops onto the stacking platform 25 which is suitably contained between plates 26 and 27. Stacking platform 25 can be spring loaded but is preferably of the type which is moved downwardly an incremental amount as cards stack thereon. The type of mechanism for controlling the movement of platform 25 does not form a part of the invention and therefore is not shown.

The leading edge of the card walks around the periphery of the stop and fan roll and finally drops onto stacker platform 25. The stop and fan roll 21 facilitates stacking the cards in an orderly pile on platform 25. As seen in FIG. 3, the cards walk around the periphery of the stop and fan roll 21 and as the trailing edge moves down further, the leading edge clears the stop and fan roll and falls onto the platform 25. In this particular example, as the cards leave feed rollers 10 and 11, they have a velocity of approximately 760 inches per second. The cards are then decelerated within a distance of approximately 2.5 inches to a velocity of approximately 500 inches per second. The stop and fan roll 21 is driven at approximately 60 r.p.m. When operating at these high speeds, it is desirable to have a front plate, not shown, which is shift of the cards in the stacker. It should also be noted that deflector 12 could be replaced by a pneumatic deflector.

The pneumatic deflectors would preferably be of the type where air normally impinges against the underside of the card. However, when the trailing edge passes the air stream, the air goes around the trailing edge to act upon the upper side of the card and force the trailing edge downwardly away from section 14 and toward platform 25. When using the air deflector, it is desirable to provide longitudinal slots in section 14 to prevent trapping of air by an incoming card.

The invention, which is illustrated in FIG. 1 as a stacker for stacking cards horizontally, can also stack cards vertically as illustrated in FIG. 4. In order to stack cards vertically, the entire mechanism including the feed rollers 10 and 11, deflector 12, deceleration plate 13 and the stop and fan roll 21 is rotated substantially 90°. The stacking platform 25 is changed to guide surfaces 35 and 36 which function to guide the trailing edge of a card as the leading edge walks around the periphery of the stop and fan roll 21. The step-like jogger plate 37 aids the cards in moving along the guiding surface 35 and 36, and against spring loaded card retainer 39. Jogger plate 37 is reciprocated by a suitably driven eccentric 38. The cards upon leaving the stop and fan roll 21 fall against the card retainer 39 which is of the type shown and described in more detail in U.S. Patent 2,964,314 to M. Fiehl, granted Dec. 13, 1960. The deflector 12 and deceleration plate 13 function in the same manner as described in connection with FIG. 1.

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:
1. Stacking apparatus for record cards comprising: a deceleration plate having one section curved at one radius and integral with another section curved at another radius so as to decelerate the cards as they follow said curved sections and to localize high-potential energy in the card which upon being stopped converts to kinetic energy to eject the card away from said deceleration plate and out of the path of an incoming card;
2. A member positioned adjacent to said another section to engage said cards under impact to momentarily stop said cards whereby the high-potential energy stored in the cards is converted to kinetic energy to eject the cards away from said deceleration plate;
3. A member for collecting cards as they snap away from said deceleration plate.
4. The stacking apparatus of claim 1 wherein said another section has a smaller radius of curvature than said one section.
5. The stacking apparatus of claim 1 wherein said another section is shorter in length than said one section.
6. The stacking apparatus of claim 1 further comprising:
means for deflecting the trailing portion of a card away from said deceleration plate as said card strikes said stop member.
7. Stacking apparatus for record cards comprising: a deceleration plate having first and second curved surfaces contiguous with each other, the radius of curvature of said first curved surface being greater than that of said second curved surface and having relative surface lengths so that a greater portion of a record card is in contact with said second curved surface and having relative surface lengths so that a greater portion of a record card is in contact with said first curved surface than said second curved surface when said record card is simultaneously in contact with said first and second curved surfaces; and means for bringing said record card in free flight into surface contact with said deceleration plate;
8. A member for locating adjacent to said second curved surface to engage under impact the leading edge of said record card whereby said card is momentarily stopped and snaps away from said deceleration plate;
9. Means for collecting said record card leaving said deceleration plate; and
10. Means for deflecting the trailing edge of said record card toward said receiving means as said record card leaves said deceleration plate.

References Cited

UNITED STATES PATENTS

2,883,929 4/1959 Eichenbaum 271—68 X

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