

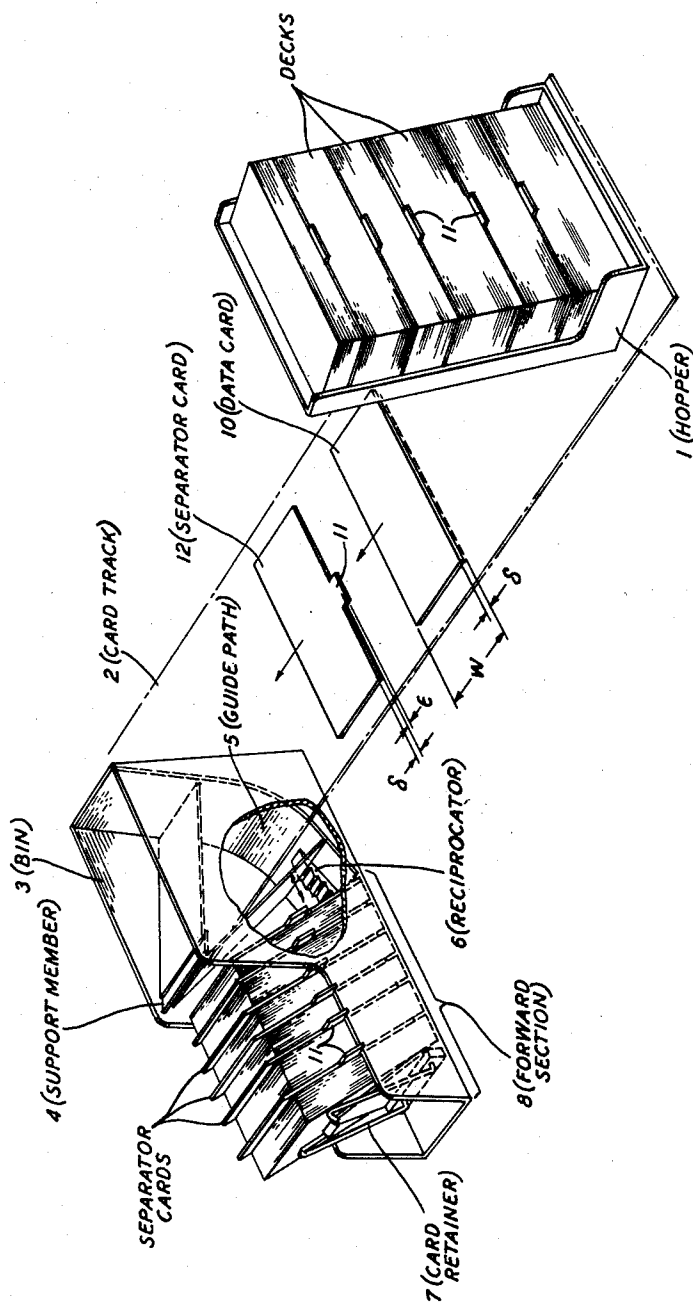
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SELF-INDEXING OF MACHINE-STACKED CARDS

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SELF-INDEXING OF MACHINE-STACKED CARDS
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This invention relates to the stacking of cards by machine and more particularly to the indexing of the cards during the course of stacking.

In the operation of an information processing unit, instructions and data are supplied to the unit by cards bearing information in the form of code markings, typically of the punched variety. For each set of instructions, a deck of the cards is inserted into the hopper of a machine which reads the cards in sequence and then stacks them in a bin.

With a modern processing unit the rate of operation is limited primarily by the rate at which the decks can be read. To speed processing, it is advantageous to keep the hopper of the reading machine continuously supplied with successive decks. Then, after the cards of one deck are read, the cards of a succeeding deck can be read without pause.

Ordinarily each deck is terminated by a card with special code markings to notify the processing unit that a deck has been completely read. The terminal card may also be coded to operate linkages which mechanically separate the cards according to deck, i.e., indexes them. However, such linkages reduce the rate at which the reading machine can operate.

Hence, it is an object of the invention to accomplish the indexing of machine processed cards without the need for auxiliary mechanical equipment. A related object is to index the cards without detriment to the rate at which reading can take place. Another object is to permit the spontaneous indexing of stacked cards without requiring changes in the structure of existing stacking machines.

While it would appear that the terminal cards could be differentiated in configuration from the ordinary information bearing cards to make the extent of each deck readily apparent, all cards are subject to critical tolerances to prevent their being misread by the reading and stacking machine. Not only are the points of change on the card limited, but, where permitted, are of necessity small to prevent the reader-stacker from jamming, so that the modifications permitted on a terminal card are generally insufficient to clearly demark, from the standpoint of visual inspection, the extents of the various decks being stacked.

Nonetheless, it is an object of the invention to have each terminal card function as an indexing or separator card as well. A further object of the invention is to provide a significant visual indexing indication without interfering with machine operation.

To accomplish the foregoing and related objects, the invention employs special separator cards between decks of data or information cards that are stacked in a bin by a card-stacking machine. Each separator card is like the usual terminal card except that its width is greater than that of the bin over a portion of one side. By contrast the other cards have a width less than that of the bin, primarily to prevent jamming.

When the cards enter the bin, they are individually driven into upright positions and formed into a stack by being repeatedly subjected to small forward and upward movements. Because of the latter and because of frictional effects in the bin, the separator cards rise spontaneously above the others, which fall back into place,

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and are held in elevated positions making the extent of each deck readily apparent.

It is an aspect of the invention that the separator cards can be proportioned to control the extent of the rise and the rate of its occurrence.

Other aspects of the invention will become apparent after consideration of an illustrative embodiment taken in conjunction with the figure which is a perspective view of a self-indexing card stacker.

During the operating sequence demonstrated in the figure, successive cards from various decks stored in a hopper 1 are caused to move along a card track 2 where they are interrogated by a reading mechanism (not shown). After being read, the cards are deflected into a stacking bin 3 near the end of the track. Initially, upon entering the bin, the cards rotate about a transverse support member 4 under the influence of gravity with their moving edges engaging a curved guide path 5. Subsequently, the cards clear the lower edge of the support member and are nudged forward by the motion of a reciprocator 6, which causes them to be stacked against a card retainer 7. As the stack increases, the retainer moves to the front of the bin where the walls are of reduced height. Because of the reciprocator motion and the tilt of the card retainer, a juggling motion that tends to prevent jamming is imparted to the cards. In addition, jamming is reduced by the dimensioning of the bin width w to be greater than that of the cards. The width of a typical card is related to that of the bin in accordance with the dimensioning indicated on the first card 10 moving along the card track. If the width of the bin at its narrowest point is designated w , the width of the card 10 is typically less than that of the bin by a first differential amount δ . The bin width w of the IBM model 1402 reading machine, which is representative, is $3\frac{3}{16}$ ", and δ is approximately $\frac{1}{16}$ ".

Ordinarily the various decks placed in the hopper would be read by the machine and stacked in the bin without a visual indication of the extent of each deck. Although mechanical indexing devices are able to separate the stacked decks, their linkages cause them to operate far below the reading speed of the IBM 1402. According to the invention, it is possible to visually demark the various decks without hindrance to high speed operability and without machine alteration. As indicated in the figure this is accomplished by providing each deck separator card with a tab 11 causing the card to engage the bin walls.

The tab 11 is located where it will not interfere with the gripping mechanism used to hold the cards in place during reading. For an IBM 1402 an appropriate location is near the center of one of the long edges as indicated for the separator card 12 moving along the card track. While the separator card, at the tab position, can have the same width w as the bin, it is advantageous for the separator card width to exceed slightly that of the bin by a second differential amount ϵ , making the tab width $\delta + \epsilon$.

Although modified, the separator card enters the bin in the same way as an ordinary card, pivoting about the support member. Typically, the bin is of greater width in the rearward section than in the forward section 8 so that the tab initially has no effect upon the motion of the separator card. However, as the bin walls narrow near the base of the reciprocator the edge of the tab engages one of them. Due to the juggling motion to which the cards are subjected, the cards tend to rise. They subsequently fall back into place, except for the separator card which is held in its elevated position, partly by the friction between the edge of its tab and the wall of the bin and partly by the weight of other cards stacked

upon it. Hence, as the juggling motion continues, the tab card continues to rise following the dotted trajectory indicated in the figure on the right-hand wall of the bin. Once the tab clears the upper edge of the wall in the forward section, the rise ceases. Thus, the extent of the rise can be controlled by changing the length of the tab. In that case the differential amount ϵ , by which the tab exceeds the bin width w must be changed in order to maintain the appropriate degree of friction between the tab and the walls of the bin.

With an IBM 1402 the differential width δ is $\frac{1}{16}$ ", and the minimum width of the tab is of that magnitude. However, when the tab is 1" in length, it is desirable to increase the tab width by a differential amount ϵ equal $\frac{1}{4}$ ". Increases in ϵ beyond that magnitude for a 1" tab have been found to cause jamming and are to be avoided. Of course, if the tab length is changed, the amount ϵ must be changed accordingly.

In the illustrated embodiment the upward and outward components of motion are attributable to the combination of a tilted card retainer and a short-stroke reciprocator, such as provided in the IBM model 1402 card reading machine. However, other arrangements can serve equally well. To increase the frictional contact between the terminal cards and the bin walls, an adhesive substance may be applied to the walls in the vicinity of the area of contact.

Card life can be prolonged by coating the tab and other edges in contact with the bin walls with a light plastic material. A suitable material is a mixture, in a one-to-one ratio by volume, of butyl acetate with a substance manufactured and sold under the name "Acryloid Solution A10". When the edges of a separator card are coated with a single brush stroke of the mixture the card life is extended well beyond the 15 to 30 runs that otherwise obtain.

For convenience the tabs are made integral with the terminal cards, which in other respects can be of the same shape, weight and material as the ordinary cards.

Other adaptations of the invention will be apparent to those skilled in the art.

What is claimed is:

1. Card apparatus comprising, in combination, a majority of data cards, a minority of indexing cards, and a bin for receiving, confining and holding upright, groups of the data cards separated by indexing cards; the dimension of each data card from side to side being less than the width of said bin; and a dimension of each indexing card from side to side being greater than that of said bin over an interior region thereof from one fixed wall to another, which said indexing card is compressed by the walls of said bin.

2. Apparatus as defined in claim 1 wherein said indexing card dimension extends over a portion of one side.

3. Apparatus as defined in claim 1 wherein the information bearing cards and the indexing cards are proportioned to have the same over-all dimensions from top to bottom.

4. In combination with a card stacking machine including a bin, of preassigned width, (1) into which each card of a width less than said preassigned width by a differential amount δ falls under its own weight unimpeded by the friction of the bin walls and (2) wherein decks of the cards are stacked by a mechanism intermit-

tently providing an upward and outward thrust; a deck separator card of elastic material having over at least a portion of one side a dimension greater than said preassigned width by a differential amount ϵ whereby the bin slightly deforms each separator card to a point such that friction between its edges and the bin walls offsets its weight and supports it through each pause in the upward and outward motion of said mechanism in a position to receive an ensuing thrust therefrom.

5. In combination with apparatus for the edgewise stacking of decks of cards in a bin whose width exceeds that of the cards, a deck separator card of elastic material having over at least a portion of one side a dimension substantially that of the bin, which card is compressed by said bin, and means for imparting a component of motion to said separator cards in the plane thereof.

6. Self-indexing card stacking apparatus comprising a majority of data cards, a minority of indexing cards, means causing all of the cards to enter a bin edgewise and in sequence, each data card having a width less than that of said bin, each indexing card having a width greater than that of said bin, and means for imparting forward and upward components of thrust to said cards, whereby the forward component of thrust causes the cards to become members of an ever increasing stack and the upward component of thrust, combined with frictional effects of the bin walls, causes the indexing cards to rise and remain above the level of the others.

7. Card apparatus comprising, in combination, a majority of data cards, a minority of indexing cards and a bin permitting increasingly augmented two-directional displacements of the indexing cards for receiving, and holding upright, groups of the data cards separated by indexing cards; the dimension of each data card from side to side being less than the width of said bin; and a dimension of each indexing card from side to side being greater than that of said bin, by which said indexing card is compressed by said bin.

8. In combination with a card stacking machine including a bin, of preassigned width, (1) into which each card of a width less than said preassigned width by a differential amount, approximately one-sixteenth of an inch, falls under its own weight unimpeded by the friction of the bin walls and (2) wherein decks of the cards are stacked by a mechanism intermittently providing an upward and outward thrust; a deck separator card of elastic material having over at least a one inch portion of one side a dimension exceeding said preassigned width by a differential amount greater than zero and less than one sixty-fourth of an inch, whereby the bin slightly deforms each separator card to a point such that friction between its edges and the bin walls offsets its weight and supports it through each pause in the upward and outward motion of said mechanism in a position to receive an ensuing thrust therefrom.

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