

Nov. 6, 1962

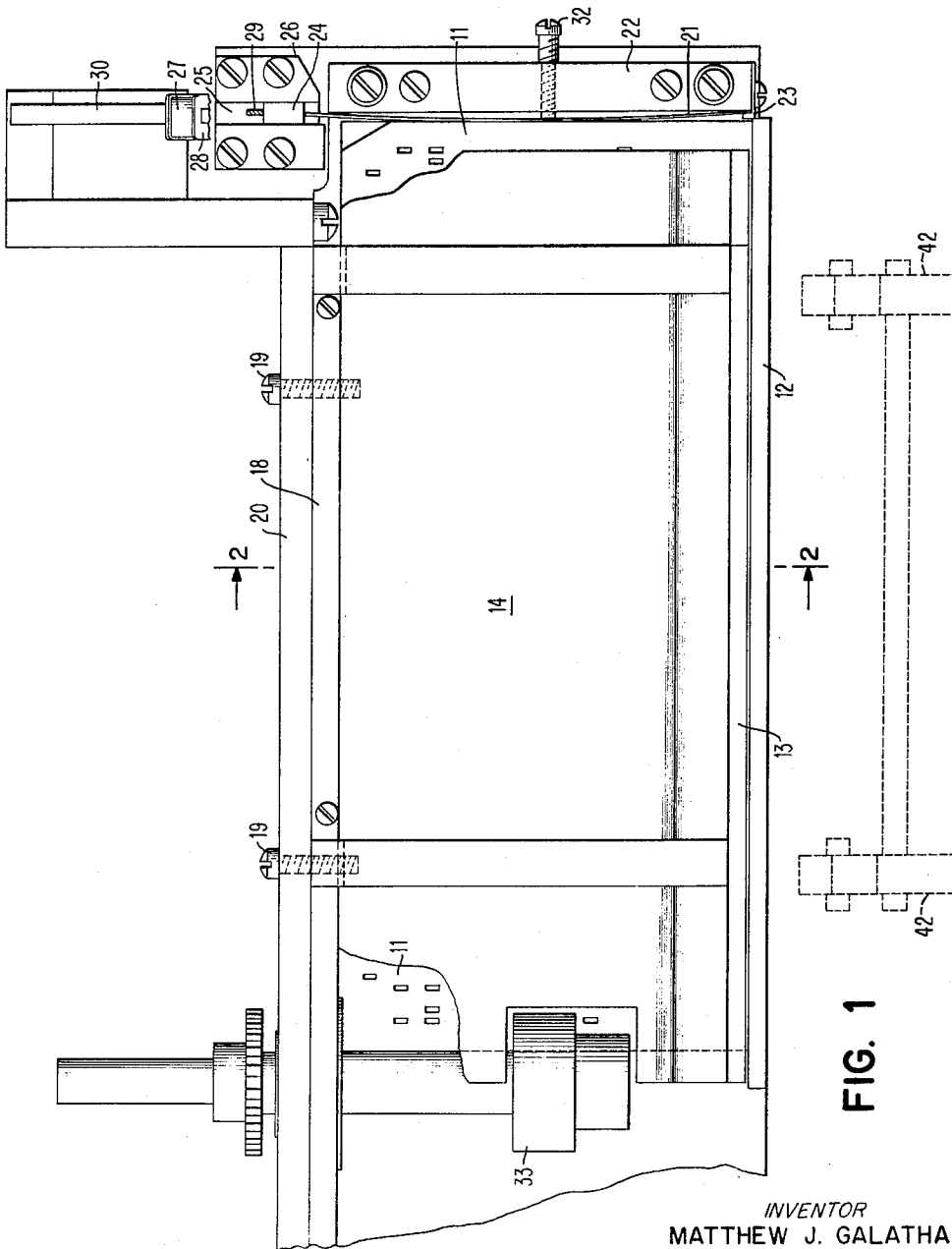
M. J. GALATHA

3,062,532

CARD ADVANCING MECHANISM

Filed Sept. 29, 1961

3 Sheets-Sheet 1



INVENTOR
MATTHEW J. GALATHA

BY

ATTORNEY

1

3,062,532

CARD ADVANCING MECHANISM

Matthew J. Galatha, Endicott, N.Y., assignor to International Business Machines Corporation, New York, N.Y., a corporation of New York

Filed Sept. 29, 1961, Ser. No. 141,755

9 Claims. (Cl. 271-5)

This invention relates to card advancing mechanism and more particularly to mechanism for striking an edge of a card and advancing it with high acceleration in a preselected direction.

The principal object of this invention is to provide a relatively inexpensive card advancing mechanism having few moving parts which are of low inertia and provide a large mechanical advantage to propel a card from rest to a high velocity at a high rate of acceleration.

Another object is to provide a card advancing mechanism of the above type which has completely random access and a very short access or response time.

Another object is to provide a card advancing mechanism embodying electro-magnetically responsive means for controlling movement of the card and wherein such movement commences even before the armature is "sealed" (i.e., fully attracted).

Still another object of the invention is to provide a card advancing mechanism especially suitable for use at a cornering station to propel cards substantially at right angles to their former direction.

According to these objects, the card advancing mechanism comprises a thin flexible column, such as a strip of spring steel, which is adapted to be contacted by the edge of a card. One end of the column is suitably retained to prevent axial movement of the column in one direction. Means, preferably the armature of an electro-magnet, is asynchronously operable to apply an end-loading force to the opposite end of the column to buckle or bow it longitudinally. With this arrangement, the central portion of the column is rapidly displaced a considerable distance laterally at high acceleration in response to a relatively low end-loading force. To assure that the column will buckle in the desired direction, means are preferably provided to pre-buckle or bow the column slightly in said direction.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of a preferred embodiment of the invention, as illustrated in the accompanying drawings, wherein:

FIG. 1 is a plan view of a cornering station employed in a card transport system and including a card advancing mechanism embodying the invention;

FIG. 2 is a section view taken along the line 2-2 of FIG. 1;

FIG. 3 is an end view taken in the direction of arrow 3 in FIG. 1;

FIG. 4 is a perspective view of the cornering station and card advancing mechanism; and

FIG. 5 is a circuit diagram of the relevant portion of the card transport system.

As shown in FIGS. 1, 2 and 4, suitably driven means is adapted to drive a tabulating card 11 long-edge first over a ledge 12 and under an upturned end portion 13 of a ribbed guide 14. The card 11 is then diverted from its angularly downward approach path to a substantially

2

horizontal path by deflecting contact with the upper surface 15 of a bed plate 16. After the leading edge of the card is thus diverted, it will enter a space between bed plate surface 15 and a parallel surface 17 constituting the lower surface of guide 14. The card will continue to move between the surfaces 15-17 until its leading edge strikes a back stop 18. Forward motion of the card will thereupon cease and its trailing edge will snap down as it moves rapidly in an arc through the generally triangular space defined between upturned end 13 and bed plate surface 15. The card will now be confined with slight clearance between the ledge 12 and stop 18, the adjacent faces of the ledge and stop being spaced slightly more than a card width apart. The ledge 12 serves to prevent rebounding of the card back from the stop 18.

As illustrated, the ledge 12 and stop 18 are formed integrally with the bed plate 16. Also, the guide 14 and bed plate 16 are suitably secured, such as by screws 19, to a back plate 20 to hold the surfaces 15, 17 spaced apart slightly more than the maximum thickness of a card.

Meanwhile, as the card 11 moves toward back stop 18, it is laterally registered by having its side edge graze along a thin flexible column 21 which forms part of the card advancing mechanism embodying the invention. This column 21 preferably is a thin strip of spring steel. One end of the column is anchored, such as by being inserted in a U-shaped slit defined between a side plate 22 and an overlying L-shaped stop 23. A low friction guide element 24, formed of such as low friction plastic, is mounted over the opposite or free end of the column 21. As shown in FIGS. 1 and 3, the guide element 24 is reciprocally mounted in a U-shaped slot 25 in a fixed member 26.

The card advancing mechanism also includes means, preferably electro-magnetically responsive, for applying an end-loading force to the column 21 to buckle or bow it longitudinally. As illustrated in FIGS. 1, 3 and 4, this means comprises a coil 27, core 28 and armature 29. The coil and core are supported on a fixed element 30 which carries a fulcrum pin 31 on which the armature 29 is rockably supported. The armature 29 projects into slot 25 and laterally abuts the outer end of guide element 24.

An adjustable screw 32 is preferably provided to bear against the central portion of the column 21 and pre-buckle or pre-bow it slightly in the direction of feed rolls 33 (see FIGS. 1 and 4). This is to assure that the column will buckle in that same direction when subjected to an endwise loading force. The bite of rolls 33 is spaced slightly beyond the edge of the card when it is loosely confined between stop 18 and ledge 12 and registered against the substantially unloaded column 21.

In operation, when the coil 27 is de-energized, armature 29 will be held spaced a slight distance from core 28 by the release-spring-like action of the column 21 which will maintain the armature biased counterclockwise as viewed in FIG. 3. This biasing action results from an inherent resiliency of column 21 which tends to maintain itself straightened except to the extent of any initial pre-bowing effected by screw 32. When coil 27 is energized, the armature 29 will be attracted to core 28. As the armature moves toward the core, and even before it is fully attracted or sealed, the armature will correspondingly move the guide element 24 translationally and thus apply a steadily increasing endwise loading force to the column 21. The thickness, length and degree of flexibility of column 21 are so se-

lected that a relatively slight endwise-applied loading force will effect a considerable buckling and lateral displacement of the central portion of the column at a high rate of acceleration. This will propel the card rapidly into the bite of feed rolls 33, which will thereafter transport it to such as a read station (not shown). As soon as coil 27 is de-energized, column 21 will promptly elongate to its former position and bias armature 29 away from core 28.

Thus, after the critical end-load on column 21 is overcome, slight further increases in end-load will effect large lateral deflections of the column with low inertia and only slight axial deformations. For example, it has been found that by using a magnet with a short sealing time and a low-inertia armature, the column can be made to deflect .250 inch in less than 2.5 milliseconds with only .020 inch armature sealing movement. A card advancing mechanism embodying the invention has advanced cards serially (short-edge first) at a rate of over two thousand cards per minute. The acceleration imparted to the card is sufficient to propel it about ten feet in free flight; and hence, feed rolls, such as 33, need not necessarily be spaced closely to the card.

A card advancing mechanism of the type described is especially suitable for use in card handling apparatus of the type illustrated generally in FIG. 4. Such apparatus preferably comprises the electro-magnetically controlled short-stroke picker knife arrangement which is fully disclosed and specifically claimed in the co-pending application of R. F. Markley, U. S. Serial No. 141,734 filed concurrently herewith. Briefly, that arrangement includes a pair of magnets 34, 35 adapted to exert oppositely acting forces on an armature 36 that is keyed to a freely rotatable, suitably supported shaft 37. Two picker knives 38 are spaced along and secured to, the shaft 37 so as to be oscillatable thereby.

Whenever magnet 34 is energized, armature 36 is attracted to oscillate the shaft 37 counterclockwise and thus rock the picker knives 38 forward in a feeding direction. As these picker knives move forward through a very short distance, they will contact the long edge of the bottom card 11 in a hopper 39 and thus advance said card forward through a throat 40 defined between stationary throat blocks 41 and corresponding continuously driven feed rolls 42. The feed rolls 42 will thereupon continue to advance the card over ledge 12 and into registry with stop 18.

As shown in FIG. 5, the coil 27 and the coil 43 of electro-magnet 34 are connected in parallel in an electrical circuit which includes a source of energy 44 and a control device 45, which for sake of simplified illustration are depicted as a battery and a manually operable switch, respectively. Thus, whenever the coils 27, 43 are concurrently energized, one card will be advanced in parallel (long-edge first) toward the cornering station bounded by 18, 21, 12; and the preceding card will simultaneously be propelled from the cornering station serially (short-edge first) into the bite of rolls 33.

The advantage of an apparatus of the type just described is that cards can be picked in parallel to avoid the frictional interlocking and greater incidence of tearing of cards which has been found to result during serial picking. This interference appears to be especially serious when the cards are densely perforated. On the other hand, it is desirable to read cards serially (i.e., column-by-column) rather than in parallel (row-by-row) to reduce costs because substantially fewer reading elements, such as brushes or solar cells, are necessary; for example, for a conventional 80-column, 12-row tabulating card only twelve reading elements are needed for serial reading, whereas eighty would be required for parallel reading.

It is to be understood that while the card advancing mechanism embodying the invention has been shown associated with a cornering station, it may be employed in a variety of other applications. For example, a card

which is selected by a suitable means from a deck may be advanced into contact with unflexed elongated column 21 by feed rolls, like 33 except rotating the other way; and, after being read while disposed between 18, 12 and 21, the feed rolls could be spread apart by electro-magnetically controlled means which is activated at the same time as the coil 27 is energized to shoot the card back through the rolls and into the deck.

While the invention has been particularly shown and described with reference to a preferred embodiment 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. Mechanism for advancing a relatively rigid light weight element in the plane of such element, said mechanism comprising a flexible column for contacting an edge of the element, means anchoring one end of the column against endwise movement, and means for applying an endwise loading to the other end of the column to cause the column to buckle and, through lateral deflection of its central portion and driving contact with said edge, rapidly advance the element in a direction generally transverse of the axis of the column, the column being of such length, thickness and flexibility that a slight axial force and degree of endwise displacement thereof effects a substantial lateral deflection of the element at high acceleration.

2. Card advancing mechanism comprising a thin flexible column for contacting an edge of a card, means anchoring one end of the column against movement, and means for applying to the other end of the column an endwise loading force to cause the column to buckle and impart a driving force to said edge to rapidly advance the card in a direction generally transverse of the axis of the column.

3. The combination according to claim 2, including means for pre-bowing the column a slight degree in said direction to assure buckling of the column in the desired direction upon endwise loading thereof.

4. The combination according to claim 2, wherein the endwise load-supplying means comprises an electro-magnet including an armature which during one condition of the electro-magnet acts on said other end of the column to apply such endwise loading and during another condition of the electro-magnet frees the column to permit it to assume a substantially unflexed and fully extended position.

5. The combination according to claim 2, including means for feeding each card into a cornering station in a direction generally parallel to the axis of the column, one side of the cornering station being defined by said column.

6. Card advancing mechanism comprising a thin flexible column for contacting an edge of a card, means anchoring one end of the column against movement, and electro-magnetically controlled means including an armature which, when attracted, operatively applies to the other end of the column an endwise loading force to cause the column to buckle and through driving contact with said edge to rapidly advance the card in a direction generally transverse of the axis of the column, said column being effective to operatively exert a releasing force on the armature when the latter is no longer held attracted.

7. Card advancing mechanism comprising a highly flexible column for contacting an edge of a card, means anchoring one end of the column against movement, guide means operatively connected to the other end of the column to constrain said other end to move in a path substantially coincident with the axis of the column, and means including an electro-magnet and an armature for operatively applying to the other end of the column an endwise loading force to cause lateral deflection of the central portion of the column and consequent advance-

5

ment of the card whenever the magnet is energized and attracts the armature.

8. The combination according to claim 7, including means for pre-bowing the column a slight degree in the direction of desired card advancement to assure buckling of the column in said direction upon endwise loading thereof.

9. In a card transport system, the combination of a hopper containing a stack of cards, a cornering station, electro-magnetically controlled picker means for feeding successive bottommost cards from the hopper toward said station, electro-magnetically controlled advancing

6

means for advancing cards from the cornering station in a plane at substantially right angles from their approach plane into said station, each of said electro-magnetically controlled means including coils forming part of a common control circuit, such that upon closure of the circuit both coils will be energized concurrently for causing one card to be moved into the cornering station by the picker means as the preceding card is being advanced from said station by the advancing means.

No references cited.