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R. F. MARKLEY
CARD FEED APPARATUS
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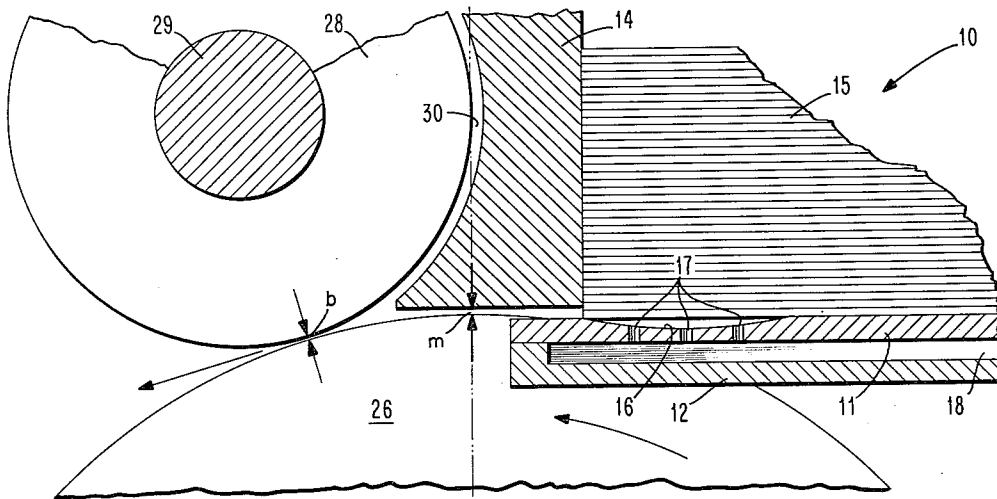


FIG. 2

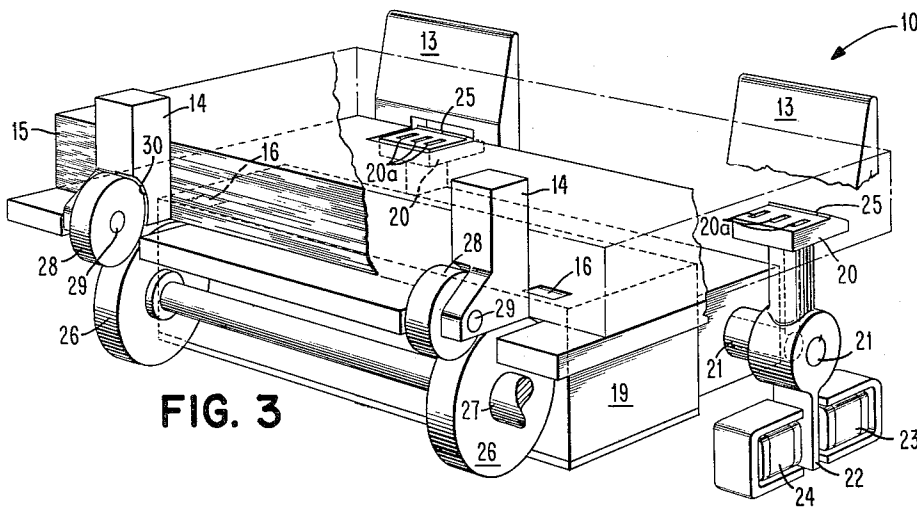


FIG. 3

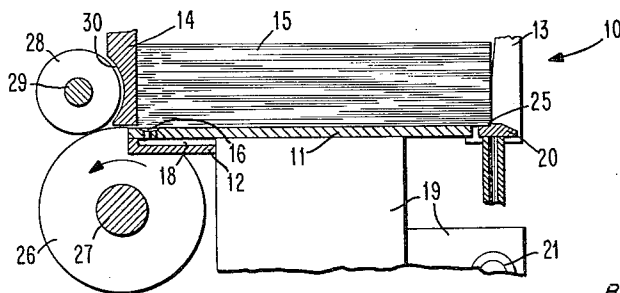


FIG. 1

INVENTOR
ROBERT F. MARKLEY

BY *Henry E. Oles*
ATTORNEY

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CARD FEED APPARATUS

Robert F. Markley, Nichols, N.Y., assignor to International Business Machines Corporation, New York, N.Y., a corporation of New York

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9 Claims. (Cl. 271—32)

This invention relates to card feed apparatus, the term "card" as hereinafter used being intended to cover tabulating cards, envelopes, or other flat articles having a certain degree of rigidity. This invention relates more particularly to an improved apparatus capable of feeding cards asynchronously at high speed edge-first from the bottom or other end of a stack in a hopper.

In U.S. Patent 2,938,722 there is disclosed an oscillatable picker knife which picks the bottom card from a stack and advances it through a throat defined between a throat knife and an idler roll. The throat knife is adjustable relative to the periphery of the idler roll to preset the throat gap or thickness at a value greater than the maximum thickness of a single card and less than the minimum thickness of two cards. As a card is fed through the throat, the idler roll is rotated by the card to distribute wear over the entire periphery of the roll. Before this roll was used, a convex surface was provided which was found to wear down due to abrasion as thousands of cards were fed through the throat. After leaving the throat, each card passes into a pair or pairs of mating feed rolls which take the card away from the hopper. The bite of these feed rolls must be spaced a relatively large distance, such as about three-eighths to one-half inch, from the throat to prevent the upper feed roll from projecting into the side of the stack.

If, with such an arrangement, electro-magnetically controlled means are used to advance the card through this relatively large distance, the armature must rock through a considerable arc even with a long moment arm. This means that the armature will have considerable inertia and require a relatively large air gap, which in turn will require a magnet of high power. Also, since the dynamic portion of the operating time of an electro-magnet increases according to the square of the armature air gap, any magnet employed in such a feed arrangement will have a relatively long operating time. Moreover, the return or release time of the magnet will be considerable because of the distance the picker knife must be retracted.

For the foregoing reasons, electro-magnetically actuated picker knives, although previously proposed, have not heretofore proved practical. However, if a card could be reliably advanced through a throat after being fed by picker knives only a very short distance, such as about .040 or .050 inch, then it would be possible to achieve the significant advantages which electro-magnetic control of the picker knives affords over conventional cam control. For example, cards can be fed asynchronously, whenever desired, without requiring a certain phase of a machine cycle to be reached, such as is necessary with cam-controlled picker knives. Also, since magnets respond considerably faster than cams, they offer the most practical solution to the problem of achieving higher feed rates.

It is to be noted that, in the patented arrangement above described, the idler roll associated with each throat knife does not pinch or drive the cards but merely floats freely and cooperates with the throat knife to define a throat gap which is thicker than a single card. Hence, this throat knife and idler roll will not pinch and advance a card if it is advanced just a short distance into the throat, nor will they start to advance a card while its leading edge is still within the throat.

The principal object of this invention is therefore to

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provide an improved card feed apparatus wherein a card need be advanced only a very slight distance from a hopper to reach the bite of a throat-defining means that also serves to continue advancing the card the rest of the way through the throat.

Another object is to provide a card advancing mechanism, including a stationary throat block and a resiliently yieldable continuously running feed roll which cooperate to define a throat having a minimum dimension or thickness at a point which is spaced very close (such as less than one-sixteenth of an inch) from the leading edge of an endmost card in a hopper.

Still another object is to provide a card feed apparatus embodying a short-stroke picker element that is electro-magnetically controlled and asynchronously operable to pick and feed cards into a take-away means with a minimum of delays thereby reducing to a bare minimum the time required to get a selected card from a hopper to a work station.

A further object is to provide a low-cost card feed apparatus which can feed cards at a rate of over two thousand cards per minute.

According to these objects, the card feed apparatus comprises at least one throat block forming part of the front wall of a hopper containing a stack of cards. A continuously rotating resilient feed roll is spaced slightly from each throat block and cooperates therewith to define a throat having a minimum thickness or dimension a slight distance (such as about one-sixteenth of an inch or less) forward of the leading edge of the stack. Means, such as an electro-magnet, is operable asynchronously whenever desired to feed the then endmost or bottommost cards successively merely said slight distance into said throat so that such card may thereafter continue to be advanced completely through the throat by the throat-defining feed rolls and throat blocks. The datum or bed plate of the hopper is preferably recessed adjacent the throat. The endmost or bottommost card is sucked against the recessed part of the plate by suction acting through suction ports in said recessed part. This is to assure that the leading part of the card will enter the throat and be fed properly even if the card should have end-to-end or side-to-side warp.

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 drawing, wherein:

FIG. 1 is a vertical section view, partly broken away, of a card feed apparatus embodying the invention;

FIG. 2 is an enlarged view of a portion of the apparatus shown in FIG. 1; and

FIG. 3 is a perspective view of the card apparatus embodying the invention.

As shown in the drawing, the card feed apparatus embodying the invention comprises a hopper, designated generally 10, defined by upper and lower bed plates 11, 12, a pair of spaced card posts 13 at the rear end of the hopper, and a pair of spaced throat blocks 14 at least in part defining the forward wall of the hopper. The upper bed plate 11 supports a stack of flat items, such as tabulating cards 15.

Two recesses or concavities 16 are provided in the upper surface of bed plate 11. These recesses extend rearward a short distance from the rear edge of the throat blocks 14 toward the card posts 13. Suction ports 17 extend downwardly through the recessed parts of bed plate 11 and communicate with a corresponding manifold 18 defined, for example, between the upper and lower bed plates 11, 12. Each manifold 18, in turn, is open to a common vacuum chamber 19 that is preferably connected

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to a source (not shown) of high volume slight vacuum air. Thus, the bottommost card, even if warped end-to-end or side-to-side, will have its leading portion sucked into contact with the concavities 16 to assure that such card will enter under the throat blocks 14.

A pair of picker knives 20 is mounted on hollow stems, each connected to a common hollow shaft 21 that is plugged or otherwise closed at its ends. The picker knives 20 have suction ports 20a which are open via the respective hollow stems of the picker knives to the interior of the hollow shaft 21; and said shaft is, in turn, open to vacuum chamber 19.

An armature 22 is disposed between the cores of two electro-magnets 23, 24 and is keyed to shaft 21 to effect oscillation of the shaft and thus of the picker knives. When magnet 23 is energized, it will attract armature 22 to rock the picker knives 20 counterclockwise, as viewed in FIG. 3. The then bottommost card 15 in the hopper will be attracted toward the suction ports 20a as respective picker knife edges 25 move forward and push on the trailing edges of such card. The picker knives 20 thus will drive the bottom card forward a short distance, such as about .040 to .050 inch, into a throat defined between each throat block 14 and a corresponding feed roll 26. The throat blocks 14 are formed of low-friction polished metal, whereas the feed rolls 26 are formed of a high-friction resilient material, such as a cork-rubber composition, so as to be radially yieldable as well as have a high coefficient of friction. The rolls 26 are keyed to a common shaft 27 which, in turn, is adapted to be continuously driven by gearing or other suitable means (not shown).

The throat is of minimum dimension or thickness at a point *m* which is at substantially the aforementioned short distance (illustratively assumed as .040 to .050 inch) from the leading edge of the bottom card before it is picked by the picker knives. The term "minimum dimension or thickness" refers to the minimum gap or space between the throat blocks 14 and their corresponding feed rolls 26. This minimum thickness is less than the minimum thickness of any one card to assure that any card, irrespective of permissible variations in its thickness, will start to be frictionally driven by the rolls 26 even before (but certainly not later than) the time the leading edge of the card reaches the point *m*. Thus, once the leading edge of a card is advanced merely the aforementioned short distance (such as .040 to .050 inch) into the throat by the picker knives 20, the rolls 26 and cooperating throat blocks 14 will take over and continue to advance the card until its trailing edge leaves the throat blocks.

The throat blocks 14 preferably have a maximum thickness of less than one-fourth inch. As illustrated, as the leading edge of the card passes beyond each throat block, it is deflected downward at a slight angle by deflector rolls 28. Each deflector roll 28 is a freely rotatable ball bearing mounted on a corresponding stub shaft 29 carried by a lug projecting forward from a corresponding throat block 14. The axes of shafts 29 are so located with respect to the axis of shaft 27 that the angle through which the card is to be deflected is tangent to the bite *b* of the rolls 28, 26 along their line of centers. The width of the gap at the bite *b* is equal to or somewhat greater than the minimum width of the throat at point *m*. It will be apparent that the greater the degree of angular deflection desired, the farther the bite *b* will be from the point *m*. Where the angle of deflection is slight, as illustrated, the throat blocks 14 are preferably recessed at 30 to receive the periphery of the rolls 28.

Thus, in summary, when magnet 23 is energized, armature 22 is attracted to cause the picker knives 20 to be rocked forward and advance the leading edge of the then bottommost card 15 from the hopper a very slight distance into the throat defined between throat block 14 and continuously rotating feed rolls 26. The throat-defining

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blocks 14 and rolls 26 take over while the leading edge of the card is still in the throat and cooperate to continue to advance the card until the trailing edge of the card finally leaves the throat blocks 14. If deflection of the card is desired after it is fed through the throat, such deflection can be accomplished by the deflector rolls 28.

Now, when magnet 23 is de-energized, armature 22 will be attracted to the core of magnet 24. Magnet 24 is illustrated as an electro-magnet having a coil with a fewer number of turns than the coil of magnet 23; and magnet 24 is continuously energized during operation of the device to operatively bias the picker knives clockwise to a retracted or ineffective position whenever and so long as magnet 23 is de-energized. If preferred, magnet 24 could, of course, be a permanent magnet.

Thus, cards 15 will be fed rapidly and asynchronously whenever magnet 23 is energized. The magnet 23 need to be given only a momentary pulse to cause it to actuate the picker knives to feeding position; and as soon as the pulse is removed, the picker knives will automatically be retracted by operation of the biasing magnet 24.

With a card feed apparatus of the type above described, cards have been fed in parallel at rates of over two thousand cards per minute.

While electro-magnetic control of picker knives is preferable because of the advantages adverted to in the preliminary discussion of the prior art, it is to be understood that the invention could be used with short-stroke card pushers or picker knives, driven either synchronously such as by cams or asynchronously by some means other than an electro-magnet.

It should also be understood that while the invention has been illustrated as applied to a "bottom feed" hopper, the invention may be applied to hoppers wherein the cards (instead of resting flatwise on a bed plate) are stacked upright on their edges and the endmost card is fed. In other words, the essential components shown in FIGS. 1 and 2 would be rotated 90°; e.g., such that the axis of shaft 27 would be vertical instead of horizontal. Accordingly, the term "endmost," as used in the claims, is intended to refer generically to the "bottommost" or "side-most" or "endmost" card at one extremity of the stack. Moreover, the use of a vacuumized bed plate and vacuumized picker knives, while preferable, are not essential. The deflector rolls 28 may also be eliminated if desired.

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. Sheet feeding apparatus comprising a hopper containing a stack of sheets, at least one stationary throat block forming part of the front wall of the hopper, and a resilient feed roll spaced slightly from each throat block and cooperating therewith to define an expandable throat and sheet-receiving bite of minimum thickness at a point a very slight distance forward of the leading edge of the stack, means for driving said feed roll continuously, means for advancing the endmost sheets successively substantially only as far as said bite such that advancement beyond said bite will be effected solely by said roll, and means asynchronously operable for effecting the advance and return of said advancing means.

2. Apparatus for feeding like flat elements, said apparatus comprising a hopper containing a stack of the elements, at least one throat block forming part of the front wall of the hopper, a feed roll spaced slightly from and substantially in line with each throat block and cooperating therewith to define a wedge-like throat and sheet-receiving bite reducing to a minimum dimension at a point a very slight distance forward of the leading edge of the stack, means for driving each such roll, and means intermittently operable to successively advance the then end-

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most elements substantially to said point in the throat for advancement therebeyond by said roll.

3. The combination according to claim 2, wherein the surface of the throat block adjacent the roll is flat, and wherein an imaginary line normal to said surface and passing through the axis of the roll is said slight distance forward of the leading edges of the stacked elements.

4. The combination according to claim 2, wherein the hopper has a datum surface, such as a bed, with a concavity adjacent the throat block, and means including a vacuum source for sucking the endmost element to the concavity to facilitate its being fed into the throat.

5. The combination according to claim 2, wherein the intermittently operable means comprises an electromagnetically controlled vacuumized picker means asynchronously energizable for driving the endmost elements to said point.

6. Card feed apparatus comprising a hopper containing a stack of cards, at least one stationary throat block forming part of the front wall of the hopper, a resilient feed roll spaced slightly from each throat block and cooperating therewith to define a wedge-like throat of minimum gap less than the thickness of a card at a point a very slight distance forward of the leading edge of the stack, means for driving each roll continuously, and electromagnetically controlled picker means asynchronously operable to advance cards successively substantially up to but not beyond said point such that the cards will be advanced beyond said point only by each such roll.

7. The combination according to claim 6, including a

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freely rotatable deflecting roll disposed adjacent the outlet end of each throat block in partially blocking relation to deflect the card from a path tangent to the feed roll at said point to a path diverted toward said feed roll.

8. The combination according to claim 6, wherein the electro-magnetically controlled means is controlled by an intermittently energizable electro-magnet which when energized actuates said control means to a card-feeding position, and magnetic biasing means effective upon de-energization of said electro-magnet to bias said control means to an ineffective position.

9. Apparatus for feeding substantially similar flat elements, said apparatus comprising a hopper containing a stack of the elements, at least one throat block forming part of the front wall of the hopper, a feed roll spaced slightly from each throat block and cooperating therewith to define a combined throat and sheet-receiving bite of minimum dimension at a point between the leading edge of the stack and the forward ends of the hopper and each throat block, such that upon a slight degree of movement of the endmost sheet forward of the leading edge of the stack it will enter said throat and bite and be driven by said roll.

References Cited in the file of this patent

UNITED STATES PATENTS

2,270,871	Felber	Jan. 27, 1942
2,617,648	Wockenfuss	Nov. 11, 1952
2,991,075	Wheeler et al.	July 4, 1961