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G. A. LUNING ET AL
CARD FEEDING MEANS

FIG. 5
RECIPROCATING TYPE PICKER

FIG. 8
FIXED ARC PICKER

FIG. 6
PICKER TRAVEL

FIG. 9
PICKER TRAVEL

FIG. 7
STRAIGHT CARD

FIG. 10
STRAIGHT CARD

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CARD FEEDING MEANS

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This invention relates to card processing equipment and more particularly to an improved card feed utilizing an oscillating rocker motion.

In accordance with the invention, a card hopper is provided with improved high speed card pickers which are oscillatable in an arc about an axis located adjacent a line projected from the rear edge of the stacked cards. When the card pickers are at their outermost limit of arcuate travel, the picker knives are disposed adjacent the rear edge of the stacked cards. On the forward stroke, the knives with the picked card are moved in an inward, slightly upward and then downward direction toward the forward portion of the hopper to translate the forward portion of the card to the first feed rollers for subsequent delivery to other card handling apparatus. Projecting backwardly and downwardly from the trailing edge of each picker knife is a card stack supporting surface, so tapered as to remain within the arc described by the top edge of its respective oscillating feed knife. Thus, during the forward and reverse strokes, the supporting surface moves beneath the stack to support the same at a substantially uniform distance from the pivot axis. This reduces the tendency for the cards to bounce at high speed operation and minimizes the possibility of a card miss or failure to pick. In addition, since the support carries the weight of the cards for a portion of the stroke, picker knife wear is reduced.

Accordingly, it is one of the objects of the invention to provide an oscillatable card picker which is capable of translating cards at high speeds with a minimum number of card picking failures.

It is another object to provide a card picker which is capable of translating at high speeds cards having curl or warp in either direction across their widths.

It is still another object of the invention to provide an oscillatable card stack support and picker which reduces the card stack weight on the bottom card during a portion of the forward stroke.

It is yet another object to provide an oscillatable picker knife for a card stack which reduces stack bounce to a minimum.

It is another object to provide a card hopper and picker construction which reduces the possibility of injury to the operator when the picker is being oscillated with no cards in the hopper.

It is yet another object to provide an oscillatable picker knife with a movable card stack support therefor which reduces picker knife wear.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of examples, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In the drawings:

Fig. 1 is a diagrammatic side elevational view of one form of card processing apparatus to which the improved card feed is applicable.

Fig. 2 is an enlarged vertical transverse sectional view of a card hopper showing the improved card picker and drive means therefor.

Fig. 3 is a partially exploded perspective view of the hopper and card feed mechanism with parts broken away to more clearly show the invention.

Fig. 4 is an enlarged detailed sectional view of the card feed head as shown in Fig. 2; and,

Figs. 5—10 are a series of diagrammatic views showing a comparison of card bounce between a standard reciprocating type picker and the improved arc type hopper.

Referring now to the drawings for a clearer understanding of the improved card feeding apparatus, there is shown a machine or mechanism in which tabulating cards may be processed in any suitable manner to obtain the desired information. In order to obtain this information, groups of cards are placed in a suitable feed hopper and are fed or passed from the hopper to the machine and are eventually deposited in a suitable stacker pocket or pockets.

With the demand for higher and higher operating speeds in card processing equipment, the standard card feed comprising reciprocating picker knives which are reciprocated in slides substantially parallel to the card stack and generally represented in Figs. 5 to 7 develop serious limitations. While pickers of this type perform reasonably satisfactorily at low feed speeds and up to speeds of 500 to 700 cards per minute under ideal conditions with substantially straight cards, it is obvious from an inspection of these figures that when operating at speeds approaching 1,000 cards per minute or better, deck instability or card bounce in the stack becomes a serious problem, particularly if the cards are warped or curled across their width. Since the cards in the hopper are physically moved upwardly by the picker with each forward stroke and lowered by gravity with each return stroke, when the standard picker is reciprocated at speeds over 700 to 800 cards per minute the impulses transmitted to the stacked cards cause them to bounce at a relatively high rate and under certain conditions they may start to vibrate or bounce in resonance which, of course, accentuates the bounce or displacement. The point at which this occurs is difficult to predict because of many variables, such as, for example, the direction of card curl, new cards, worn and warped cards, and so forth.

When the bounce reaches a certain magnitude, the picker knife may miss the rear edge of the bottom card, this results in machine stoppage and the operator is then required to manipulate switches or the like to restart the operation. However, due for one reason to the fact that the cards normally rest on the picker slides, what occurs quite often is the cards are rocked and the forward edge of the bottom card may be displaced so that when the rear edge of the card is picked, the bottom card is jammed against the throat knife and is damaged or destroyed. Several cards may be thus mutilated before the machine is stopped. This of course is a troublesome problem and is time consuming.

Accordingly, it is to overcome the above-mentioned disadvantages of the reciprocating card picker at high speed operation that this invention is particularly directed. Referring specifically to Figs. 2—4, a suitable frame construction is provided to support all of the mechanism required to accomplish the card feed operation. The card hopper includes a forward or front wall spaced from a bottom wall to define a throat passage, and walls, only one of which is shown, and a rear wall defined by a pair of upwardly extending guide posts secured to a support bar. With the exception of the bottom wall, these walls cooperate to receive and hold the stack of cards in position. At the lower central portion of the front
and secured to the picker head 37 to form a portion of the rear end thereof is a U-shaped metal member 52 providing a backwardly and downwardly tapering top surface 53 which as adapted to support the card stack during a portion of the forward and reverse strokes of the picker knives 37 and 42. This support takes place after the bottom card is picked on the forward stroke just prior to the positioning of the picker knife at the rear edge of the card on the return stroke. The taper of this movable card support 53 is such that its outer peripheral dimensions remain within the arc described by the picker knife edges 41. With a construction of this type, a portion of the card support always remains at a substantially constant distance from the pivot axis. Openings 54 may be provided in the support 52 to permit access to the picker head supporting bolts 43. It has been found that to accommodate various degrees of card warpage the rear card support surface should preferably be a cord of the described arc between the feed knife edge and trailing edge of the support. By supporting the card stack in this manner during portions of the feed stroke, direct wear on the upper surface of the feed knives is reduced.

The rear wall of the hopper comprising the pair of upright card posts 21 have their lower portions recessed at 55 adjacent the picker heads 37 to provide clearance for the supporting plates 52 during the return stroke of the picker knives. In addition, the trailing edge of the supports 52 are of such length as to not entirely leave the recedes 55 at the end of the forward stroke. The slots 35 in the base member are likewise closed at all times by means of the upper head portions 44 of the rocker arms and the picker knife heads 37. Thus, as the picker knives are oscillated in an arc, the slots in the base and recesses in the posts are always substantially covered or sealed at all times against the entrance of large objects. This eliminates the danger of injury to the operator should his finger be placed near the slots 35 in the base or recesses 55 during reciprocation of the picker knives when the hopper is empty.

By referring to Figs. 2 and 4, it can be seen each feed knife edge 41 is at the apex of two oppositely tapering surfaces, the rear card support surface 53 tapers backwardly and downwardly with respect to the oscillatable feed head axis while the forward card surface 39 including the top surface of the free end 44 of the rocker arm slopes downwardly and forwardly toward the base 17 of the hopper. Also, that each feed knife edge 41 and its forward support 39 is disposed above the bottom wall 17 of the hopper 11 as are the throat rollers 24. Thus, when cards are placed in the hopper 12, the forward portion rests on the forwardly tapering picker support 39 at the proper angle for picking. Should the cards be warped or curled longitudinally, the picker heads 37 automatically swivel about their respective posts to accommodate for such warp.

In operation, the operator places a stack of cards 11 in the hopper 12 to rest on the throat rollers 24 and picker heads 37, places the standard weight member 56 on the top card and initiates the card processing operation through suitable control means (not shown). As the machine begins to operate, the drive shaft 31 is rotated at the desired speed which in turn rotates the feed rollers 26 and 27, respectively, through the feed rolls and knife 24 and 29, respectively, and oscillates the rocker arms 45 and the picker heads 37 carried thereby in an arc through the cam follower 51 in timed relation. At the outermost limit of arcuate travel of the feed knives, the knives

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reach zero speed and this represents their substantially maximum vertical displacement from the pivot axis as provided by the rocker shaft 47. Starting from this point of zero speed, the card stack is supported on the forward supporting surfaces 39 and as the feed knife edges 41 are moved inwards by the cam followers 51, they engage the rear edge of the bottom card at a very slight upward angle at relatively low velocity, in the range of 9 inches per second, after which the velocity is uniformly increased at a very rapid rate. It can be seen that as this initial acceleration occurs, the weight of the stack holds the bottom card in position. After this initial movement of the rear edge of the picked card is moved inwards and downwards toward the bottom wall 17 without interference therefrom and this action forces the forward end of the card through the throat 18 to engage the first pair of feed rolls 26 and 27, respectively. At the point of engagement with the feed rollers, the card is moving at its maximum velocity which is approximately the same velocity as the feed rollers. For example, at a feed rate of 1,000 cards per minute the velocity of the card at the point of leaving the picker knife is approximately 67 inches per second. At the point of roll pickup, the rotating rollers slow down and stop the arc feed knives and start reversal of the stroke.

During the interval when the bottom card is being translated forward, the rearwardly tapering card support 53, carried at the trailing edge of the feed knife edges, are moved in under the rear edge of the next card and they support the stack at a substantially uniform distance from the pivot axis, regardless of the distance of travel of the feed heads 37. In this manner frictional forces normally provided by the weight of the stack after initial acceleration do not interfere with the bottom card movement. Upon the return stroke of the feed knife, the supports 53 continue to hold the stack in this substantially uniform position until the feed knife edges pass beyond the rear edge of the card. At this point the stack drops by gravity on the forward supporting surface 39, placing the rear edge of the bottom card adjacent the picker knives. The remaining cards are consecutively fed in like manner.

By referring to Figs. 8 to 10, it can be seen that with the use of an arc type card picker as disclosed and tapering or relieving the rear card support 53 to stay within the arc described by the feed knife edge 41, card bounce is reduced to a minimum within wide limits of card curl and other conditions. By maintaining the bottom wall 17 of the hopper space from the supporting means the forward edge of the cards will remain on the throat roller 24 so that the stack may pivot about this point during the card feeding operation. This prevents jamming of the cards against the throat knife 23.

The pronounced reduction in card bounce under three typical operating conditions is even more evident when these figures are compared to Figs. 5 to 7 which, as mentioned previously, disclose cards under similar conditions using the standard reciprocating card feed. By comparing Figs. 5 to 10, it can be seen card bounce has been reduced from .180 to .045 inch with ⅛ inch convexly curled cards; has been reduced from .210 to .045 inch with cards having concave curl of ¼ inch; and has been reduced from .030 to .025 when feeding straight cards. In the specific example disclosed, the feed knife is oscillated in an arc having a radius of approximately 29 inches and the pivot axis is approximately ¾ inch inward from a line projected from the rear edge of the stacked cards.

With respect to upper limits of card feeding speeds, the arc type picker described is capable of speeds over 2,200 cards per minute with straight and curled cards without failure. In addition, due to the control of the velocity at the point of card picking, damage to the rear edge of the cards has been practically eliminated. The above is well beyond the upper limits of the reciprocating pickers under similar card conditions.

In the above examples only static conditions are considered and it is evident that when high speed operation of the various inertia forces are considered, card bounce would actually be considerably higher. Thus, with the dependance on gravity return at high picker speeds, it can be readily understood why card loss occurs with the reciprocating card picker. In cases where the card stack is supported by the reciprocating picker slides and the incidence of rocking occurs from this point the card bounce of the bottom card may be elevated to the degree where it engages the throat knife at the time of picking and be destroyed or damaged.

In the above description high picker speed has been stressed, however, it is to be understood the arc type picker may be used at low feed speeds equally as well for the same reasons. In addition, at low speed operation with the removal of the return cam and cam follower a cost reduction is realized when compared to the standard reciprocating picker. At high speeds the initial cost is substantially the same, however, a reciprocating picker requires rapid and will require frequent replacement. Thus, when compared over a long period of use and low maintenance cost the arc picker is superior in this respect also.

From the above, it can be seen that when feeding cards at high speeds, card stack bounce has been reduced to a minimum value and this result has been proved in actual practice to have practically eliminated card picking failures or jamming at the throat knife. Also with a card picker of this type, damage to the rear edge of the card has been practically eliminated because the card picker is moving at a substantially low speed at the time of picking and from this point the picker smoothly and quickly accelerates the card to maximum velocity without eccentric impulses applied thereto and with a minimum of frictional interference, or none, from the card stack.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art, without departing from the spirit of the invention. Intention, therefore, to be limited only as indicated by the scope of the foregoing claims.

What is claimed is:

1. A card feed for consecutively advancing stacked cards from a hopper, comprising a head having a forward and a rear edge and a top surface, a feed knife edge formed on said top surface intermediate said ends, said top surface being relieved from said feed knife edge toward both ends to provide a forward and rear card supporting surface, a rocker arm mounted to pivot on an axis adjacent a line projected from the rear edge of said cards, means for mounting said head on said rocker arm to provide for swivel movement on an axis normal to said feed knife edge, and means for operating said rocker arm to oscillate said feed knife edge in an arc to advance the cards, said rear supporting surface supporting the unpicked cards at a substantially uniform distance from the rocker arm axis during the forward and reverse stroke of said feed knife edge.

2. A card feed for consecutively advancing aligned stacked cards from a hopper, comprising a head member having an upper surface, a feed knife edge formed on said upper surface defining the outermost projection of said head and extending parallel to the rear edge of the cards to engage the same, a rocker arm and an axis adjacent a line projected from the rear edge of the stacked cards, means for securing said head member to the upper end of said rocker arm, said last-named means including a connection to journal said head mem-
for swivel movement on an axis transverse to the rocker arm axis, means for oscillating said rocker arm in an arc about said axis, to move said feed knife edge into contact with the rear edge of the bottom card at such an angle to maintain the stack against the bottom card during initial acceleration of the same, and a rearwardly directed projection defining a card support secured to said head member in back of said feed knife edge to support the unpicked cards during the forward stroke of said feed knife edge but after the initial acceleration of the picked bottom card, said support being tapered with respect to said axis to remain within the arc described by said feed knife edge.

3. A card feed for consecutively advancing stacked cards from a hopper, comprising a head member having a forward and a rear end and a top surface, a feed knife edge disposed on the top surface of said head intermediate said ends, said top surface being tapered downwardly from said feed knife edge toward both ends to provide a forward and a substantially flat rear card supporting surface, a rocker arm mounted to pivot about an axis disposed inwardly from but adjacent a line projected from the rear edge of the stacked cards, means for securing said head intermediate said ends, said rocker arm, an axis transverse to said rocker arm axis, means for oscillating said feed knife edge on an axis defined by a journal connection to provide swivel movement of said feed knife edge about an axis transverse to said rocker arm axis, and means for oscillating said feed knife edge on an axis defined by a journal connection to provide swivel movement of said feed knife edge to the upper free end of the said card feed head and card support on an axis transverse to said rocker arm axis, and means for securing said card feed head in an arc about the rocker arm axis whereby the rear edge of the picked card is moved in a forward and downward direction, said card support being tapered inwardly with respect to the rocker arm axis and moving said feed knife edge below the stack to support the same at a substantially uniform distance from the rocker arm axis to minimize bouncing of the stacked cards during oscillation of said card feed head.

5. In a card feeding unit, the combination of a hopper for receiving stacked cards and having a lower forward throat section through which cards are consecutively transversed, a card feed head including a feed knife edge for engaging the rear edge of the lower card, a rearwardly projecting card support behind said feed knife edge for supporting the rear portion of the stacked cards, a rocker arm disposed below said hopper pivoted to oscillate about an axis substantially in alignment with a line projected from the rear edge of the stacked cards, means for securing said card feed head to the upper free end of the said rocker arm to position the feed knife edge at the rear edge of the cards when the rocker arm is adjacent its uppermost limit of travel, said last-named means including a journal connection to provide for rocking movement of said card feed head and card support on an axis transverse to said rocker arm axis, and means for oscillating said card feed head in an arc about the rocker arm axis whereby the rear edge of the picked card is moved in a forward and downward direction, said card support being tapered inwardly with respect to the rocker arm axis and moving said feed knife edge below the stack to support the same at a substantially uniform distance from the rocker arm axis to minimize bouncing of the stacked cards during oscillation of said card feed head.

6. In a card feeding unit, the combination of a hopper for receiving stacked cards and having a lower forward throat section through which cards are consecutively transversed, a card feed head including a feed knife edge for engaging the rear edge of the lower card, a rocker arm disposed below said hopper pivoted to oscillate about an axis substantially in alignment with a line projected from the rear edge of the stacked cards, means for securing said card feed head to the upper free end of the said card feed head and card support on an axis transverse to said rocker arm axis, and means for oscillating said card feed head in an arc about the rocker arm axis whereby the rear edge of the picked card is moved in a forward and downward direction, said card support being tapered inwardly with respect to the rocker arm axis and moving said feed knife edge below the stack to support the same at a substantially uniform distance from the rocker arm axis to minimize bouncing of the stacked cards during oscillation of said card feed head.
the rocker arm axis to minimize bouncing of the stacked cards during oscillation of said card feed head.

8. In a card feeding unit, the combination of a hopper including a base portion for receiving aligned stacked cards and having a lower forward thrust section through which cards are consecutively translated, means for supporting a portion of the forward edges of the cards at the throat section out of contact with said base, a card feed head including a feed knife edge for engaging the rear edge of the lowermost card and a rearwardly projecting portion defining a card support behind said feed knife edge for supporting the rear portion of the cards out of contact with said base, a rocker arm disposed below said hopper secured to a rocker arm shaft to oscillate about an axis substantially in alignment with a line projected from the rear edge of the cards, bearing means for supporting said rocker arm shaft, means for securing said card feed head to the upper end of said rocker arm, said last-named means including a journal connection to provide for rocking movement of said card feed head on an axis transverse to said rocker arm axis, and means for oscillating said rocker arm and said card feed head in an arc about its axis whereby the rear edge of the engaged lowermost card is moved in a forward and downward direction toward said base while the remaining cards are supported on the card support at a substantially uniform distance from said shaft axis to minimize displacement of the stacked cards during oscillation of said card feed head, said rocker arm shaft bearings providing the sole support for the rear portion of the aligned card stack.

9. In a card feeding apparatus, the combination of a hopper having front, side and bottom walls and a guide member including a recessed portion defining a rear wall, said bottom wall being slotted adjacent the recessed portion of said guide member, a feed head member including a card feed knife edge thereon disposed in said slotted portion of said bottom wall and having a rearwardly extending section projecting in the recessed portion of said guide member, a rocker arm mounted to pivot about an axis, means for securing said feed head member to said rocker arm, and means for oscillating said rocker arm and said feed head member in an arc, said feed head member and rearwardly projecting extension maintaining the slot in said bottom wall and the recessed portion of said guide member covered at both extremes of movement of said oscillatable rocker arm.

10. In a card feeding apparatus the combination of a hopper having front, side and bottom walls and guides defining a rear wall, each of said guides having a lower recessed portion, said bottom wall being slotted adjacent the recessed portion of each of said guide members, a card feed head including a card feed knife edge thereon disposed in each of said slotted portions and having a rearwardly extending section projecting into the recessed portion of said guide members, rocker arms mounted to pivot about an axis, an upper end portion carried by each of said rocker arms disposed in each of said slots, means for securing one of said card feed heads to the upper end portion of each rocker arm, and means for oscillating said rocker arms and said card feed heads in an arc, said upper end portions, associated card feed heads and rearwardly directed extensions cooperating to maintain the related slots in said bottom wall and the adjacent recessed portion in said guide members closed at both limits of arcuate travel of said rocker arms.

References Cited in the file of this patent

UNITED STATES PATENTS

192,519 Leavitt June 26, 1877
2,677,543 Ohrn May 4, 1954

FOREIGN PATENTS

464,213 Great Britain Apr. 14, 1937