

Oct. 15, 1968

J. H. MacNEILL

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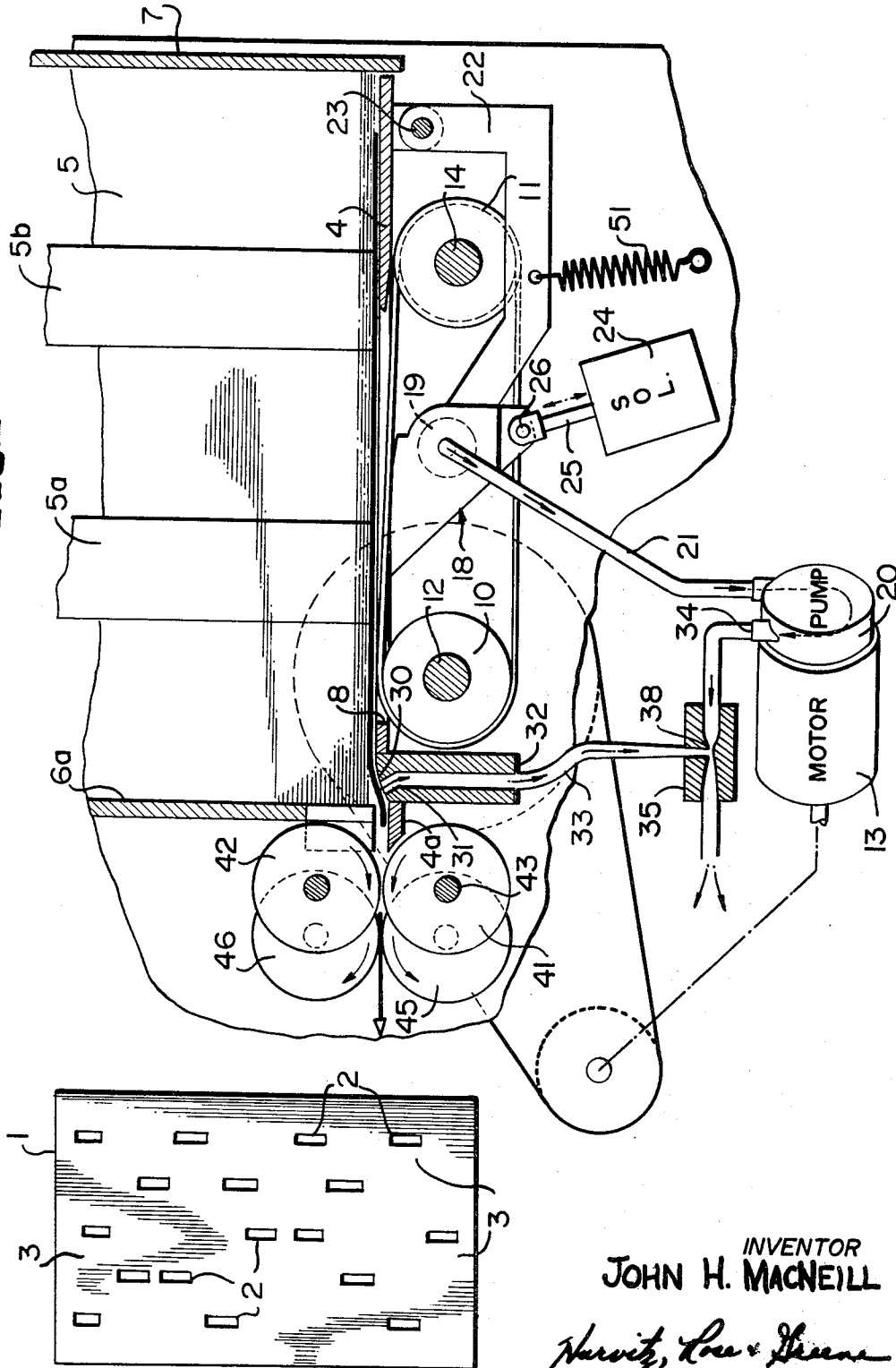
CARD PICKER MECHANISM

Filed Dec. 30, 1966

3 Sheets-Sheet 1

FIG. 2

FIG. 1



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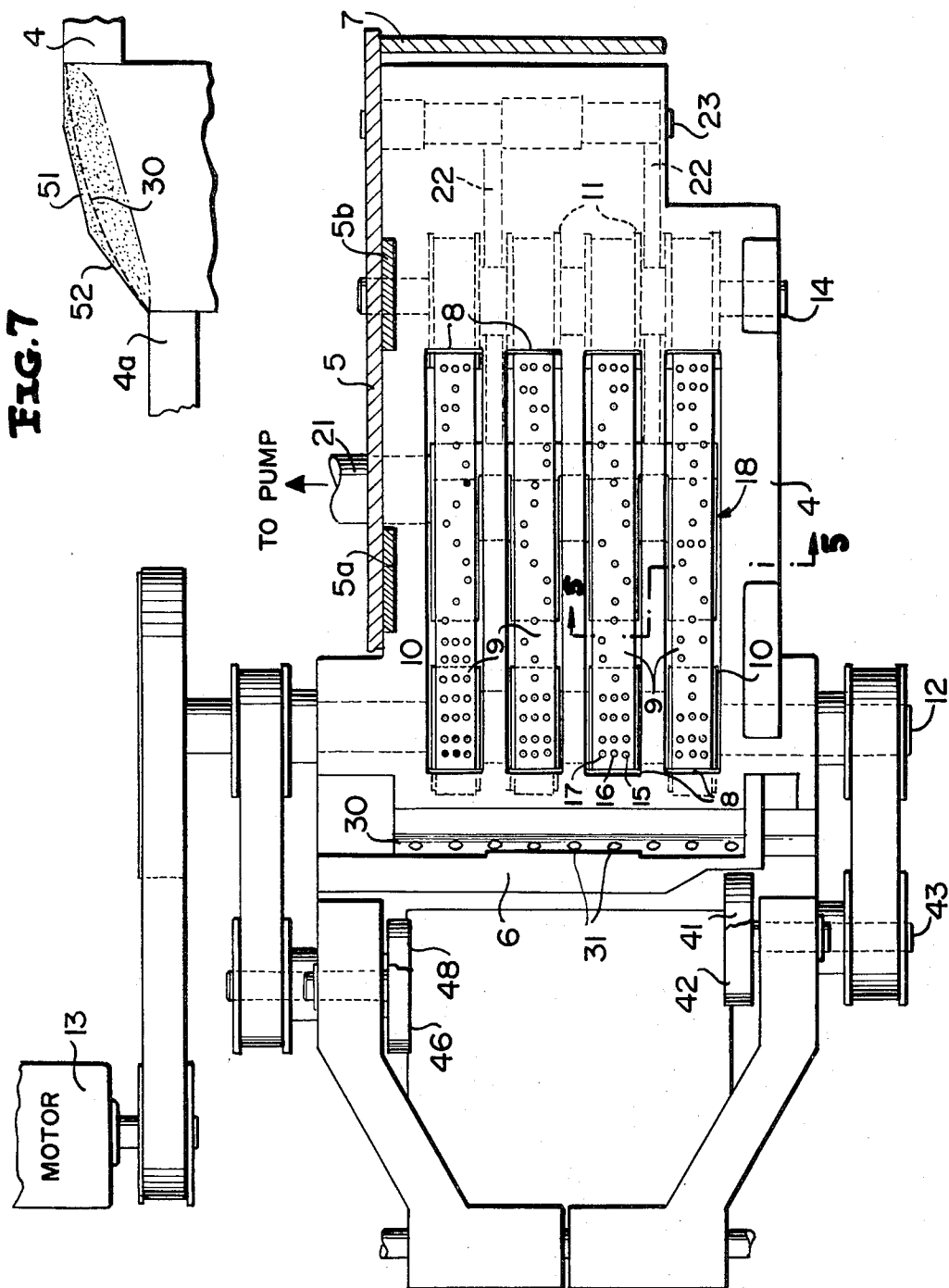
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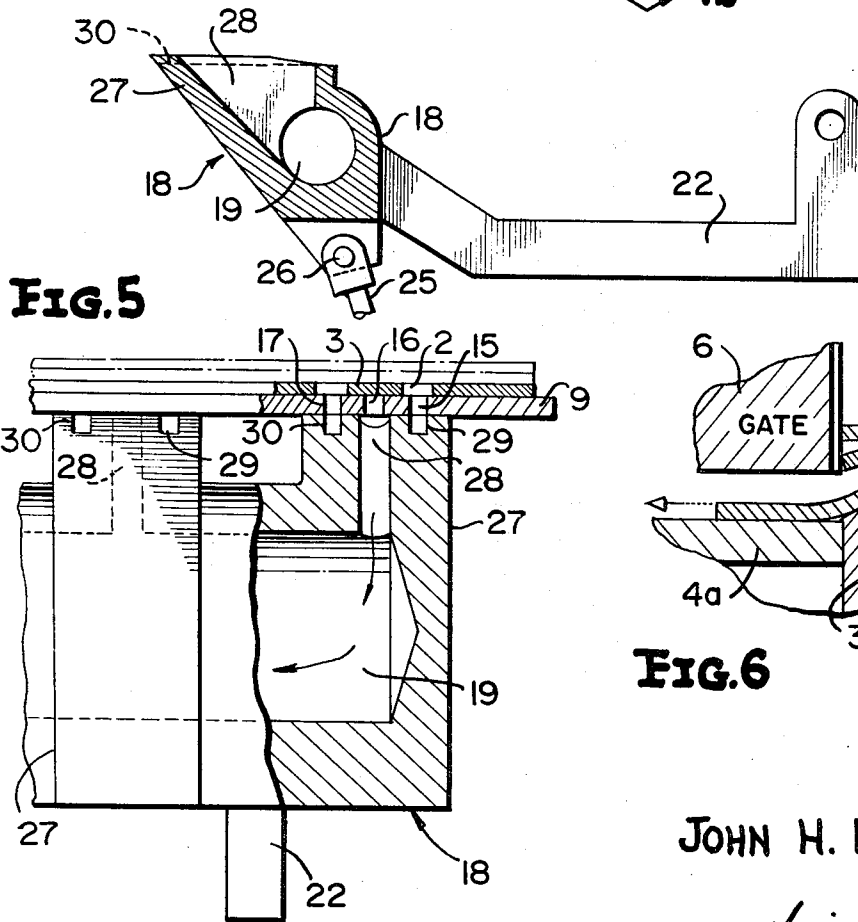
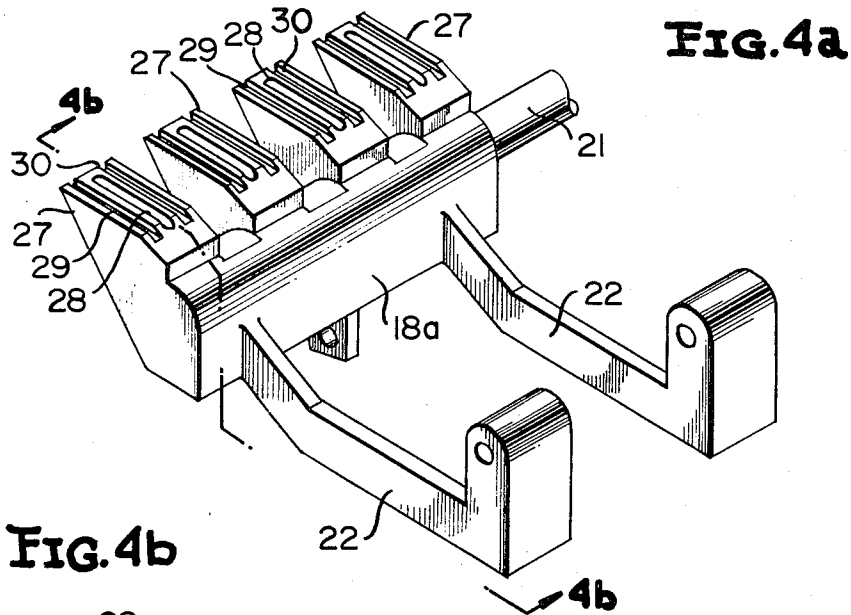
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CARD PICKER MECHANISM

Filed Dec. 30, 1966

3 Sheets-Sheet 3



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CARD PICKER MECHANISM

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Filed Dec. 30, 1966, Ser. No. 606,304

40 Claims. (Cl. 271—11)

ABSTRACT OF THE DISCLOSURE

A card picker mechanism for removing the lowermost sheet of material from a stack. The apparatus employs one or more continuously driven friction belts disposed under the lowermost sheet of the stack and normally out of engagement therewith. The belts have a first plurality of holes through which a suction force is applied to solid (web) portions of the underside of the lowermost sheet and also have a second plurality of holes for venting the region of the lowermost sheet in the region of which is normally found punched data holes; thereby preventing the vacuum from being transferred to adjacent sheets. Also included is a member for pushing the driven belts into contact with the lowermost card and concurrently applying the suction force thereto. The member is provided with a contoured surface to reduce friction between the member and the belts. The picker mechanism is also provided with a throat through which the individual sheets are driven, the throat being defined by a throat block and a beveled surface of the plate which supports the stack. A mechanism is employed for supplying a suction force through ports in the beveled surface. The slope of the beveled surface is greater than the natural flexure of an individual sheet overhanging the beveled surface so that the suction force acts to separate the lowermost card from the stack sufficiently for it to pass under the throat block which blocks such passage of all other cards; application of the force may be synchronized with delivery of individual sheets so as to be applied to a delivered sheet only for a period sufficient to permit the sheet to pass beneath the throat block. The apparatus may also be provided with two pairs of offset pinch rollers for receiving a sheet delivered through the throat and steering the sheet into proper alignment with a predetermined sheet transport path.

CROSS REFERENCES TO RELATED APPLICATIONS

The invention described herein in part represents improvements of the picker mechanisms disclosed in the following U.S. patents and patent applications:

(1) Ser. No. 316,410, filed Oct. 15, 1963 by Silas R. Halbert, now U.S. Patent No. 3,252,702;

(2) Ser. No. 323,025, filed Nov. 12, 1963 by Silas R. Halbert and John H. MacNeill, now U.S. Patent No. 3,245,681;

(3) Ser. No. 483,530, filed Aug. 30, 1965 by Silas R. Halbert.

All three of the above inventions are assigned to the same assignee as the instant invention.

SUMMARY AND BACKGROUND OF THE INVENTION

The present invention relates generally to the art of sheet-feeding and more particularly to improvements in picker mechanisms for successively feeding individual sheets from a stack of sheet-like material.

One aspect of the invention relates to an improved version of the Card Picker Mechanism disclosed in the above-referenced U.S. Patent No. 3,245,681, wherein the mechanism is of the type comprising a plurality of con-

2

tinuously driven endless friction belts arranged to be selectively extended into driving engagement with web portions of the bottom surface of the lowermost card of a stack; the apparatus further including an arrangement for delivering a partial vacuum to the bottom of the card through a plurality of spaced holes in the belts such that the vacuum is supplied to the web portions of the card to hold the card in engagement with the belts. By means of such a mechanism, it is possible to provide high speed sequential delivery of punched and unpunched cards to a desired location. Since the amount of driving force applied to the bottom surface of the lowermost card is directly related to the amount of belt surface area in contact therewith, it is desirable to employ belts of relatively large width. However, wide belts overlap not only the web portion of the card at which the suction force is applied, but also overlap adjacent punched data holes. This creates a problem in the form of occasional suction force leakage through apertures in the lowermost card to the next adjacent card in the stack thereby possibly producing a suction force against the adjacent card with the result that the lowermost and adjacent card are simultaneously fed from the stack in overlapped relation. In said one aspect of this invention, this problem is solved by providing a relatively large supply of air at atmospheric pressure at the lowermost card of the stack in the region of the punched holes in said card. This supply of atmospheric air assures that the pressure in the region of these punched holes is maintained sufficiently close to atmospheric pressure that any vacuum leakage as described above does not attract the second lowermost card.

In supplying the vacuum through the belt holes to the lowermost card, the picker mechanism disclosed in the above-referenced U.S. Patent No. 3,245,681 employs a belt pusher member having a hollow portion in which a vacuum is developed and transmitted through apertures in a surface of said member, the surface being selectively movable against the driven belts so as to bring the belts into frictional engagement with the lowermost card of the stack. Since the surface containing the apertures is substantially rectangular it presents a sharp leading edge to the moving friction belt, which tends to wear away the belts, provide leakage between the apertures of said hollow member and the holes in said belt, and impede the motion of said belts. To eliminate these difficulties, in a second aspect of this invention, the hollow member has a somewhat contoured surface to provide a smoother engagement of said belt and the leading edge of the belt pusher mechanism apertured surface.

While the improved means of imparting a driving force to the lowermost card of the stack (described above as comprising the first aspect of this invention) substantially reduces the possibility of plural cards being fed from the stack in over-lapped relation, the presence of the frictional forces acting between the lowermost and second lowermost cards precludes the complete elimination of such a possibility. It is necessary therefore to provide a gate structure adjacent the leading edges of the cards in the stack which permits passage of only one card at a time. In the above-referenced U.S. Patent No. 3,245,681 one such structure is described wherein a stream of air is directed at an angle toward the leading edge of the lowermost card as the card approaches a gate structure. If two cards approach the gate structure, the air stream tends to force its way between them, pushing the lowermost card against the support surface to insure its passage beneath the gate structure and raising the leading edge of the second card so that it abuts the front surface of the gate structure where it remains until the lowermost card has been driven entirely beyond the gate structure.

3

The effect of the air stream was further enhanced by developing a suction force beneath the lowermost card immediately adjacent the gate structure to assure that the lowermost card was not lifted by the airstream. The above referenced patent application number 483,530 describes an improvement over this gating device in the form of an undercut or step formed in a baseplate which supports the card stack, the undercut being provided adjacent the gate structure. A suction force delivered at the lower surface of the undercut tends to draw the leading edge of the lowermost card toward the baseplate to reduce its degree of contact with the second card thereby assuring separation of the two cards by the air stream directed at their leading edges. It has been found however that the suction force applied at the undercut in the baseplate tends to leak off at the sides of the lowermost cards, the leakage path consisting of the generally triangular space between the bottom surface of the lowermost card and the walls defining the rectangular undercut. Since leakage reduces the effect of the suction force applied at the undercut, separation of adjacent cards is not always assured.

In a third aspect of this invention the above problem is solved by providing the suction force at a beveled surface substituted for the undercut such that the lowermost card is generally drawn into engagement with and assumes the contour of the beveled surface. There is substantially no leakage between the underside of the card and the beveled surface due to the close engagement therebetween. In addition, the beveled surface has a steeper slope than that provided by the natural droop of a card overhanging the beveled surface. Thus, when the lowermost card is drawn towards the beveled surface by suction force, it is also drawn away from an overlapping card in a positive manner since the overlapping card is not subjected to the suction force and does not have enough natural droop to follow the contour of the beveled surface. The gate structure is positioned sufficiently close to the beveled surface to block passage of such an overlapped card, and the lowermost card above is fed beneath the gate structure. The positive separation of overlapping cards made possible by the beveled surface provided in accordance with this aspect of the invention enables elimination of the air stream directed at the leading edges of the cards insofar as that stream was required to initiate separation. In addition, the positive separation of overlapping cards permits utilization of larger throat openings in the gate structure and base plate than were previously possible, the reasons for and advantages of which are discussed in greater detail infra.

In still another aspect of this invention, the application of the suction at the beveled portion of said support surface is interrelated to the application of a vacuum through the friction belts to the lowermost sheet in the stack. In particular, it is recognized that for some applications, once the leading edge of the card passes beneath the gate structure the suction developed at the beveled surface beneath the gate structure is no longer required and, in fact, tends to provide a frictional force between the card and the baseplate which produces wear of the card and the structure in the region the gate. In view of these considerations, means are provided wherein a suction is produced at the beveled surface whenever the friction belts are not in contact with the lowermost card of the stack. When the suction is applied through the friction belts to the lowermost card of the stack, the suction at the beveled surface remains for a short predetermined delay period, sufficient to permit the leading edge of the lowermost card to pass under the gate. After this delay period, the suction at the port is reduced and is not fully redeveloped until after suction is removed from the friction belts.

In still a further aspect of this invention, means are provided for steering the sheet-like material after passage

4

through the gate structure to assure that it is properly aligned with the transport path along which it is to travel. This means for steering comprises two pairs of drive rollers, a first pair of which is positioned on one side of the transport path to receive said sheet-like material immediately upon its egress from said gate, and a second pair of which is positioned on the opposite side of said transport path to receive said sheet-like material somewhat after it is received by said first pair of driven rollers. In this manner, the first pair of rollers applies a net initial torque on the sheet-like material which tends to rotate the leading edge thereof toward the opposite side of the transport path where a guide wall is located.

It is therefore an object of the present invention to provide a picker mechanism for delivering data cards or other sheet-like material through a gate and onto a transport path at a high rate of speed by means of one or more driven friction belts having holes therein through which a suction force is applied to the card being delivered, and with which is associated means to assure that only one card at a time is delivered.

It is another object of this invention to provide a high speed picker mechanism for punched cards and other sheet-like material in which a differential pressure is developed across the card to maintain the lowermost card in contact with a support plate of the apparatus and in which drive belts are selectively extended above the surface of the support plate and into driving arrangement with the lowermost card, wherein the mechanism for extending the drive belts also delivers a vacuum to the underside of the cards, and wherein means are provided for supplying atmospheric air in the region of punched holes in the lowermost card to prevent vacuum leakage between the belt and the card from applying a suction force to the second lowermost card through the punched holes in the lowermost card.

It is still another object of the present invention to provide a high speed picker mechanism for data cards and sheet-like material in which one or more constantly rotating friction drive belts are initially disposed below a surface of a support on which the lowermost part of the stack rests and in which a mechanism is provided for delivering a vacuum to the underside of the belts; the mechanism being movable so as to push the belts above the surface of the support plates and into engagement with the adjacent surface of the lowermost card whereby the vacuum is applied through a plurality of spaced holes in the belts to a web portion of the card to thereby hold the card against the belts so that the card may be driven from the mechanism; the mechanism additionally comprising means for supplying air at atmospheric pressure to said adjacent surface of the lowermost card at a portion thereof which contains punched holes situated adjacent said web portion.

Yet another object of this invention is to provide a high speed picker mechanism for data cards and other sheet-like material comprising a drive mechanism for delivering individual cards from a stack of cards supported on a support plate through a gate and onto a transport path, said gate comprising a structure extending transversely across the entrance to said transport path above a beveled portion forming a decline in said support plate, said beveled portion having a plurality of ports formed therein for communicating with a partial vacuum producing means for applying a suction force to the lowermost card delivered from said drive mechanism, said beveled portion being at such an angle with respect to the supporting surface of the support plate as to prevent a card which overhangs the beveled portion from making contact therein in the absence of a suction force applied through said ports.

Another object of this invention is to provide a card picker mechanism having means for preventing feeding of more than one card at a time, said means comprising means for separating the leading edges of overlapping

5

cards and means for blocking passage of one of said overlapping cards to a card transport path.

It is yet another object of the present invention to provide means for aligning punched data cards and the like during their traversal of a card transport path, said means comprising two pairs of drive rollers, the pairs being offset from one another along the longitudinal direction of the transport path and spaced on opposite transverse sides of said path so as to apply a net torque to each card to effectively drive said card against a fixed guiding surface.

The above and still further objects, features and advantages of the present invention will become apparent upon consideration of the following detailed description of one specific embodiment thereof, especially when taken in conjunction with the accompanying drawings, wherein:

FIGURE 1 is a plan view of a type of punched data card suitable for use with the present invention;

FIGURE 2 is a plan view of the apparatus of this invention;

FIGURE 3 is a top view of the apparatus of this invention;

FIGURES 4a and 4b are top and plan views, respectively, of the belt pusher mechanism employed in this invention;

FIGURE 5 is a sectional view taken through lines 5—5 of FIGURE 3;

FIGURE 6 is a detailed plan view of the gate mechanism employed in this invention; and

FIGURE 7 is a detailed plan view illustrating the manner in which a portion of the invention may be machined.

Referring now specifically to FIGURE 1 of the drawings, there is illustrated a type of data or punched card which is described herein merely for purposes of reference in describing the apparatus of the present invention. The card, which is generally designated by the reference numeral 1, has a plurality of columns generally designated by the reference numeral 2 in which holes or apertures may be formed by a punching mechanism in order to record information on the card. Information may be applied in accordance with decimal code, a binary code or other well-known suitable codes. As indicated immediately above, the various holes are punched in rows which extend parallel to the longitudinally extending edges of the cards and between each of these rows are web portions of the card which do not receive holes and supply the continuity of the structure. These web portions are generally designated by the reference numeral 3, remain continuous no matter how fully punched or laced a card may be and are of particular interest in the present invention. It will be noted that the web portions 3 extend along the longitudinal peripheries of the card and also in strips between the various rows to and in which information is to be recorded.

Referring now specifically to FIGURES 2 and 3 of the accompanying drawings, the apparatus of the present invention comprises a support plate 4 which is bounded along one edge by a wall 5. At the left edge of the apparatus as viewed in FIGURE 2, there is a gate structure 6 extending transversely of and above the transport path for the cards and under which a selected card is to be fed. The height at which gate structure 6 is disposed above the support plate 4 is discussed in greater detail infra. The cards in the picker mechanism rest against guide rails 5a and 5b, which are secured to wall 5, a front guide plate 6a, which extends upwardly from gate structure 6 in transverse relation to the transport path, and a rear guide plate 7 extending upwardly from support plate 4 and parallel to plate 6a. The distance between front guide wall 6a and rear guide wall 7 is approximately equal to the length of the cards being fed. Support plate 4 thereby supports the stack of cards to be fed, the cards being urged against support plate 4 either by gravity or by means of a weighted card follower (not illustrated).

As best illustrated in FIGURE 3, support plate 4 is provided with four rectangular slots 8 which extend com-

6

pletely through the support plate and which are parallel to the path along which the individual cards are to travel. Endless friction belts 9 are normally disposed below support plate 4 and are aligned with respective ones of the rectangular slots 8. The belts are each disposed about a different pair of rollers 10 and 11, rollers 10 being the drive rollers and rollers 11 being the idlers. All of the power rollers 10 are secured to a shaft 12 driven by means of a continuously rotating drive motor 13 through a suitable gearing or belt and pulley arrangement. The idler rollers 11 are supported on a shaft 14 and the shafts 12 and 14 are journaled in and extend between the guide wall 5 and an opposing support wall (not illustrated in detail).

As illustrated in the particular embodiment being described, each of the belts 9 is provided with a plurality of apertures or holes arranged in three columns 15, 16 and 17, respectively, each column extending along the entire length of its respective belt 9. It is not absolutely essential that there be three columns of holes, since as will be understood from the following description, two such columns may suffice. The holes in each column are arranged in transverse alignment with the holes of the other columns such that the total effect of the arrangement is to provide a plurality of three-hole rows extending along the entire length of each belt. It is not essential that there be a transverse alignment relationship between corresponding holes in the various columns, however, so long as the holes are aligned with the card in the following manner. The holes in the central columns of holes 16 are positioned so as to align with web portions 3 of the card 1 illustrated in FIGURE 1, while columns of holes 15 and 17 are aligned with portions of the card normally allotted to receive apertures as information is inserted in the card. Naturally, the spacing of the slots 8 on the support plate 4 must be arranged accordingly. The belts 9 are normally located so as to be disposed below the surface of support plate 4 as best illustrated in FIGURE 2 so that, under normal circumstances, the lowermost card of the stack which rests on the support plate 4 is not engaged by the continuously driven belts 9.

As illustrated in FIGURE 2, there is disposed substantially centrally of the longitudinal length of the belts 9 and between the upper and lower parallel lengths thereof, a belt pusher mechanism 18 employed to provide a vacuum to the apparatus and also to force the upper length of belts 9 into engagement with the lowermost card of the stack; that is, the card which is in engagement with the support plate 4. The vacuum developed by the belt pusher mechanism 18 is applied to a hollow portion thereof 19 by an exhaust pump 20 through flexible tubing 21. Exhaust pump 20 is driven by motor 13, which as described above, also drives the pulley arrangement for belts 9.

Referring again to the pusher mechanism 18, it is secured to a pair of arm members 22 pivotally mounted between guide wall 5 and its opposing wall (not illustrated) at a point slightly below support plate 4 and somewhat rearward of slots 8 with respect to the direction of feed. A supporting rod 25 secured to the armature of a solenoid 24 supports the belt pusher mechanism 18 at its undersurface 25, and as to be subsequently described, transmits the force necessary to selectively move the belt pusher mechanism 18 into engagement with the belts 9.

As best illustrated in FIGURES 4a and 4b, the belt pusher mechanism 18 includes a manifold 18a having a hollow passage 19 from which four members 27 extend upwardly, each member 27 being disposed in vertical alignment (as illustrated in the figures) with a different one of the belts 9. The upper surface of each member 27 is substantially rectangular and has an elongated aperture 28 formed therein which extends downwardly its communication with hollow passage 19. Thus, a vacuum formed in passage 19 communicates with the atmosphere surrounding the belt pusher mechanism 18 through the elongated aperture 28. Disposed on opposite sides of and

generally parallel to each elongated aperture 28 is a pair of rectangular recesses or channels 29 and 30 formed in the upper surface of each member 27, and extending longitudinally across the entire length thereof. Channels 29 and 30 are aligned to communicate with columns of holes 15 and 17, respectively, of belts 9. It is thus seen that the holes of columns 15 and 17 in belts 9 are always in communication with atmospheric pressure since channels 29 and 30 have access thereto at their extreme end portions even when the belt pusher mechanism 18 is in contact with the belts 9.

When the belt pusher mechanism 18 is pushed into engagement with the belts 9, the belts are forced against the lowermost card resting on support plate 4, and since the vacuum apertures 28 are aligned with the holes in column 16 of belts 9 and in turn with the web portions 3 of the lowermost card, the card is pulled into tight frictional engagement with the driven belts 9, which act thereby to remove the lowermost card from the stack. At the same time and as best illustrated in FIGURE 5, channels 29 and 30 permit air at atmospheric pressure to communicate with holes 2 in the lowermost card via columns of holes 15 and 17 in the belts 9 so to prevent the suction from aperture 28 from leaking between the belt 9 and the lowermost card, through holes 2 and to the next card in the stack which otherwise could and usually does produce a suction clamping force on the second lowermost card. Such force often is responsible for both of the two lowermost cards being driven to the gate concurrently, on occasion producing a jam, and the above structure eliminates one of the reasons for two cards being delivered concurrently.

As illustrated in FIGURE 2, a simple mechanism is provided for moving the belt pusher mechanism 18 into contact with belts 9 and comprises solenoid 24 which has two stable conditions between which its armature (not specifically illustrated) translates. A support rod 25 is fixedly secured to the armature of the solenoid 24 and to the belt pusher mechanism 18 by a pivot member 26 so as to support the belt pusher mechanism in both positions of the solenoid armature. Specifically, in the normal condition with the solenoid not energized, the belt pusher mechanism 18 is retracted and is disposed somewhat below the belts 9, thereby permitting the belts to assume their natural contours below plate 4 and out of contact with the lowermost card of the stack supported by support plate 4. Also, since mechanism 18 is out of contact with belts 9, the vacuum at apertures 28 is satisfied by atmospheric air flow around mechanism 18 and the vacuum is not transmitted to the holes in the belts 9. When the solenoid is energized, support rod 25 moves upwardly pushing the belt pusher mechanism into forceful engagement belts 9 directing the suction force to the card webs 3 through the holes 16 such that the belts are brought into tight frictional engagement with the lowermost card of the stack. The action of pulleys 10 and 11 drives the belts 9 and thereby removes the lowermost card from the stack in the direction toward gate member 6. After the solenoid is de-energized, the mechanism 18 is rapidly retracted due to the elasticity of the belts 9. It is expected that in some applications the elasticity of the belts will not provide a rapid enough retraction of mechanism in which case a return spring 51 may be provided, the spring being secured to the belt pusher mechanism 18 and to the frame of the apparatus.

As best illustrated in FIGURE 4b, the upper surfaces of the four extended members 27 of belt pusher mechanism 18 are contoured somewhat toward their rear-most portions; that is, the ends of the upper surfaces which are most remote from gate 6. The purpose of this contouring is to facilitate the motion of driven belts 9 over these upper surfaces, for without it, the belts 9 would initially make contact with a relatively sharp edge which would tend to gouge and wear out and impede the speed of the belts. The contour provides a much smoother transition

for the belts in contacting the belt pusher mechanism and thus enhances life of the apparatus and reduces energy losses in the system.

As illustrated in FIGURE 2, a card which has been removed from the bottom of a stack is delivered by the continuously driven belts 9 toward a gate structure 6. A narrow throat region is defined between the gate structure 6 and support plate 4 in a manner to be subsequently described. The width of the throat should be small enough to block passage of two cards therethrough simultaneously and yet should be large enough to permit passage of single cards having burred leading edges. Gate structure 6 and the elements associated therewith are employed to prevent delivery of two overlapped cards to the transport path and ultimately to the utilization device while optimizing the ability to deliver damaged cards.

Referring specifically to FIGURE 6 in which the dimensions of the various elements have been exaggerated in order to facilitate an understanding of their operation, the leading edge of a card which is removed from the stack is driven along support plate 4 and approaches a beveled surface 30 thereof immediately prior to reaching the gate structure 6. Beveled portion 30 slopes downwardly from support plate 4 to a further support plate 4a, the slope being sufficiently great that the natural curvature or flexure of a card overhanging surface 30 is less than is necessary for the card to remain in contact therewith. The leading surface of gate structure 6 is disposed adjacent and parallel to the beveled portion 30 and is located sufficiently below the level of the second card 36 in the stack and sufficiently close to the bevel 30 that any card delivered from the stack without having a flexed leading edge is engaged by the gate structure. The considerations involved in determining the exact location of the gate structure 6 to the bevel 30 and plate 4 will be discussed subsequently.

Beveled surface 30 has a plurality of spaced ports 31 extending in a column across the width of the plate 4, the spacing of the ports 31 being such that they are all aligned with web portions 3 of the cards. Ports 31 communicate with a manifold 32 (FIGURE 2) which is secured to the underside of beveled surface 30 and which is capable of applying a suction force at the ports 31 in a manner to be subsequently described. A suction force applied at ports 31 draws the leading edge of a card passing over beveled surface 30 of support plate 4 against said beveled surface so as to permit it to pass under gate structure 6. If two cards are inadvertently delivered in overlapped relation toward gate 6, as for example cards 36 and 37 in FIGURE 6, the suction applied at ports 31 acts to draw the lowermost card 37 against beveled surface 30 permitting it to pass under the gate. The suction is not transmitted to the overlapping card 36, however, and since its natural flexure when overhanging surface 30 is insufficient to permit it to pass under gate structure 6, card 36 is effectively separated from card 37.

The distance between the lowest extremity of gate structure 6 and the support plate 4a is determined by the following factors. The standard IBM punched data card has a thickness of .007 inch. In a perfect environment, the distance between the gate 6 and the plate 4a could therefore be .007 inch to insure passage of but a single card beneath the gate. However, with continued use, the cards develop burred leading edges which effectively increase the thickness of the leading edge of the cards by as much as 75 percent. To accommodate such cards, the distance between the gate and the plate 4a must be somewhat greater than .007 inch but, on the other hand, must be less than that which would permit two cards to be inserted beneath the gate simultaneously. The throat width required between the gate structure 6 and the support plate to prevent such simultaneous card insertion must be somewhat less than twice the thickness of a single card, because the overlapping card may be slightly bowed so as to present an inclined leading edge to the gate struc-

ture, thus initially presenting less than two full card thicknesses to the gate. In addition, the throat width must be small enough to permit the vertical surface of gate structure 6 to intercept a reasonable portion of the thickness of the leading edge of overlapping card 36. It has been found that a throat width distance of the order of .011 to .012 inch between the gate 6 and the support plate provides the optimum width for preventing card jams while still permitting passage of burred or damaged cards. This compares with .008 to .009 inch throat widths employed by prior art devices, a width which results in frequent jams due to card burring.

While the above discussion deals with dimensions as they are required to provide a suitable gate for standard IBM punched data cards, it is to be understood that a similar analysis is applicable for an apparatus which is designed to handle other types of sheet-like material having different thickness. Thus, the factors are now determined for location of the gate structure 6 and closely tied thereto the vertical height of the bevel 30. The gate structure 6 is located so as to form a throat having a width of approximately .011-.012 inch. The bottom surface of the gate structure 6 may be aligned with the top surface of plate 4 or it may be disposed below or above, depending upon the bevel slope required to prevent the natural card flexure from following the bevel contour and also depending upon the card width which the throat is to accommodate. Under these conditions, the second lowermost card, even if assisted to some small extent by vacuum leaking through holes in the lowermost card, can not pass beneath the gate structure 6. Practically speaking, since the slope of the bevel 30 is such that the lowermost card can follow the contour of the bevel and thus provide a fairly good seal to the vacuum, little, if any, vacuum is developed on the second lowermost card.

Another consideration which merits discussion at this point is the manner in which the beveled portion 30 is to be provided. The beveled portion 30 of FIGURE 6 is illustrated as being continuous and smooth, properties which are not economically achievable with direct machining techniques. Specifically, a rather short longitudinal dimension of beveled portion 30 (i.e., along the direction of the path of card travel) is required in order to minimize the additional frictional force provided between cards leaving the stack and the adjacent cards when the card is removed at an angle as opposed to removal along a plane parallel to the cards. In order to achieve the desired shape for beveled portion 30, a process, as illustrated in FIGURE 7, is employed wherein a pair of flat, contiguous angled surfaces 51 and 52 are machined in that order, to approximate the desired final surface curvature. When the apparatus is placed in use, the constant passage of cards over the sharp corners formed by surfaces 51 and 52 gradually wear away these edges to form the desired surface for beveled portion 30 as indicated by the dotted line in FIGURE 7. It is important that metal surfaces 51 and 52 be hardened to a depth below the desired contour portion 30 (as illustrated by the cross-hatched region in FIGURE 7) so that when the cards wear the edges down to the desired contour, the smoothed resulting surface of portion 30 is part of the hardened area. Of course, one may employ a technique wherein one or more surfaces such as 51, 52 are machined, and wherein the desired contour is achieved by card wear.

Returning again to the operation of the apparatus of the present invention, since the suction applied at ports 31 draws the card tightly against the surface of beveled portion 30, it produces frictional forces which act in opposition to the driving force of belts 9 and thus impedes the movement of the card through the gate 6. For some applications, these frictional forces may be desirable in order to stabilize the load on a card being delivered from the stack which load may vary as the number of cards in the stack decreases. Also, where a card hopper is employed such as the one disclosed in the above referenced U.S.

patent application No. 483,530, wherein the load caused by the stack is stable, the frictional forces may be desirable to limit total load variations in card driving forces which might otherwise tend to skew the card in relation to the transport path. For many applications however, these frictional forces are undesirable and act to reduce the number of cards that can be delivered in a unit of time. In these latter situations therefore, it is desirable to minimize the time during which a card is subjected to maximum suction force to that time required to insure that the lowermost card is under the gate. In another feature of this invention, the application of suction to the cards through ports 31 may be limited to the leading edge portion of each card. As illustrated in FIGURE 2, manifold 32 is secured to ports 31 and communicates via tubing 33 with the throat portion 38 of a venturi tube 35. The venturi tube 35 is located between the high pressure side of the pump 20 and atmosphere. The pump 20, it will be remembered, provides the required suction for belt pusher mechanism 18. The outlet port of venturi tube 35 communicates with the atmosphere so as to provide a dump for air being exhausted by pump 20. In accordance with the well-known operation of the venturi tube, air passing through venturi tube 35 produces a low pressure in its throat 38 which is a function of the velocity and mass of air flowing therethrough. Thus, pressure at throat 38 is considerably lower than atmospheric pressure when air flows freely through the system. However, when flow through the system is reduced, pressure at ports 31 rises towards atmospheric pressure. Considering again the operation of belt pusher mechanism 18, it will be remembered that in the normal condition (i.e., no card being fed) the belt pusher mechanism 18 is displaced from belts 9 so that apertures 28 have free access to surrounding atmosphere and a relatively large quantity of air flows through the system. Under such conditions, exhaust flow is present at outlet port 34 of pump 20 and a resultant large suction is developed at ports 31 as previously described. When the belt pusher mechanism is moved into engagement with belts 9, the air supply to the pump 20 is greatly reduced since the supply of the atmosphere to apertures 28 is substantially blocked by the web portions of the lowermost card in the stack. As a result, once the belt pusher mechanism 18 engages the belts 9 and after the pump 20 evacuates the hollow passage 19, tubing 21, etc., air flow through the system is greatly reduced and the degree of vacuum developed at ports 31 also is greatly reduced. However, as pointed out above, there is no immediate reduction of vacuum at ports 31 since air in the system must first be evacuated, a process which requires a finite time delay. This time delay may be made sufficiently long to enable the leading edge of a card being removed from the stack to pass under gate structure 6. Specifically, the lowermost card can be subjected to the full force of the vacuum at ports 31 and passed undisturbed below gate structure 6 before the vacuum is reduced at ports 31. Control of this delay period depends on such factors as speed of the delivered card, distance between the belts 9 and ports 31, fluid capacity of the pump and its system, etc., all of which must be appropriately considered in attaining the required delay.

For systems where the suction cut-off feature, as described immediately above, is not required, the tube 32 may be connected to the inlet port of pump 21 by appropriate fluid conducting means. If desired a valve may be inserted in such conducting means and arranged to block suction to tube 33 in accordance with the motion of belt pusher mechanism 18.

At times, a card leaving a picker mechanism is skewed relative to its path of travel and according to another feature of the present invention, mechanisms are supplied to correct this condition. As best illustrated in FIGURES 2 and 3, a card egressing from gate structure 6 is first picked up by a pair of drive rollers 41 and 42, positioned respectively below and above the transport path so as to

engage respectively the lower and upper surfaces of an egressing card. The rollers 41 and 42 are positioned so as to be aligned with that edge of an egressing card which is remote from guidewall 5. A second pair of drive rollers 45 and 46 are positioned slightly further along the transport path in the feed direction so as to be aligned with the edge of an egressing card which is adjacent guidewall 5.

The rollers 41, 42 and 45, 46 are driven such as to propel the card at a slightly higher velocity than the egress velocity from the picker mechanism. This, coupled with the fact that rollers 41 and 42 engage the card slightly before rollers 45 and 46, produces a net torque on the card tending to steer it toward the guidewall 5. The result of this torque is to develop a force on the card, during its entire period of engagement by the rollers 41 and 42, urging the card toward wall 5 and thus insuring proper alignment of the card relative to the card transport mechanism to which it is to be delivered.

In summarizing the operation, when it is wished to eject a card from the stack, the solenoid is energized so that support rod 25 extends belt pusher mechanism 18 towards belts 9 which are, in turn, brought to tight frictional engagement with the bottom surface of the lowermost card of the stack. In this position of the belt pusher mechanism 18, a vacuum is transmitted to the web portions 3 of the card via pump 20, tubing 21, hollow passage 19, apertures 28 and holes 16 in belts 9. At the same time, the hole portions 2 of the lowermost card remain subject to atmospheric pressure via channels 29 and 30 and belt holes 17 and 15 so as to prevent leakage between hole 16 in the belt and hole 2 in the lowermost card from providing a suction force on the card immediately above the lowermost card. The frictional force supplied by the belts against the lowermost card drives the card toward gate structure 6. Meanwhile since the leading edge of the card overlies beveled surface 30, and since a suction force still exists at ports 31 due to the delay in evacuating the existing air in the fluid system connected to pump 20, the leading edge of the card is maintained in tight engagement with beveled surface 30 so as to permit the card to pass under gate structure 6. Upon egressing from gate structure 6, the card is first picked up by drive rollers 41 and 42, which tend to steer the card in toward guidewall 5, and is then picked up by drive rollers 45 and 46, which in combination with the rollers 41 and 42, propel the card along the transport path to a utilization device generally disposed transversely between rollers 41, 42 and 45, 46.

While the air stream employed in the above referenced U.S. Patent 3,245,681 and U.S. patent application No. 483,530 to separate the leading edges of overlapped cards is not required for the same purposes in the device disclosed herein, such stream may be employed for the purposes of creating an air cushion or air bearing between the lowermost and second lowermost cards. Such an expedient reduces the frictional force between these adjacent cards and thereby enhances speed of card feeding.

It is seen that the apparatus of the present invention, due to the placement of the belts and the method of communicating a vacuum through the belts to the card and of communicating atmospheric air through the belts to the card, is capable of picking a lowermost card of a stack of cards and rapidly transporting it to a gate mechanism with minimum chance of card overlap. In the event that such overlap does exist, the nature of the beveled surface preceding the gate structure, the suction provided thereat, and the location of the gate structure are all such that only one card passes under the gate structure at a time. In this manner, the apparatus of this invention insures a high degree of reliability as to feeding only a single card and as to minimizing jams due to card burring. Although the apparatus

as illustrated and described employs four belts, it is not intended that this be a limiting feature of this invention. The standard IBM card provides a fourteen-web structure so that any number of belts, from one on up may be employed to conform to the specification and requirements of a particular system.

In addition to the choice available as to number of friction belts to be employed, it should be apparent that the widths of the belt or belts may be made suitable to the requirements of a particular system. For example, where a large driving force is required, one rather wide belt would prove efficient in that it presents a large surface area and produces a correspondingly large frictional force against the lowermost surface card.

While I have described and illustrated one specific embodiment of my invention, it will be clear that variations of the details of construction which are specifically illustrated and described may be resorted to without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. A picker mechanism for feeding individual sheets from a stack of sheet-like material, portions of said sheet-like material being suitable for containing coded data in the form of perforations therein, said mechanism being of the type comprising a plate having a support surface for supporting said stack of sheet-like material, said plate having at least one slot extending therethrough to permit selective engagement of the lowermost sheet in said stack by a portion of at least one continuously driven endless friction belt, said belt having a first plurality of holes extending therethrough and spaced along the entire length thereof in alignment with unperforated portions of said sheet-like material, feed initiating means for selectively moving said portion of said belt into engagement with said lowermost sheet and for developing a suction at said lowermost sheet through selected ones of said first plurality of holes, whereby said lowermost sheet is removed from said stack in the direction in which said belts are driven, the improvement comprising:

a second plurality of spaced holes extending through said belt and disposed adjacent respective ones of said first plurality of spaced holes in alignment with the portions of said sheet-like material which are suitable for containing perforations;

means for venting the space contiguous to portions of the sheet-like material which are suitable for containing perforations through selected ones of said second plurality of holes in said belt when said belt is in engagement with said lowermost sheet, said selected ones of said second plurality of holes being those which are adjacent said selected ones of said first plurality of holes.

2. The picker mechanism of claim 1 wherein is provided a plurality of said continuously driven endless friction belts and a respective plurality of slots extending through said support plate for permitting said belts to selectively engage said lowermost sheet therethrough and wherein said feed initiating means comprises:

a generally hollow member extending under said portions of said portions of said belts,

a plurality of apertures extending through a surface of said hollow member and communicating with the hollow region of said member, each aperture being disposed in alignment with said selected ones of the first plurality of holes in a respective belt,

means for developing a partial vacuum in the hollow region of said hollow member.

3. The picker mechanism of claim 2 wherein said means for venting includes a plurality of recessed channels in said surface of said hollow member, said channels communicating with atmospheric pressure and disposed adjacent respective ones of said plurality of apertures and

in alignment with said selected ones of the second plurality of holes in respective belts.

4. The picker mechanism of claim 3 wherein said first plurality of holes are disposed in a first column along the entire length of each belt, and the second plurality of holes are disposed in second and third columns spaced on opposite sides of said first column along the entire length of each belt.

5. The picker mechanism of claim 4 wherein said feed initiating means additionally includes means for translating said hollow member between a first position, in which said hollow member extends said portions of said belts into engagement with said lowermost sheet, and a second position, in which said hollow member is located remote from said belts.

6. The picker mechanism of claim 5 wherein said means for translating comprises a solenoid having an armature selectively actuatable to either of two predetermined conditions, means secured to said armature for supporting said hollow member in said first and second positions thereof in accordance with the condition of said armature.

7. The picker mechanism of claim 6 further comprising gating means for receiving said individual sheets from said stack and for preventing simultaneous passage therethrough of more than one sheet.

8. The picker mechanism of claim 7 wherein said gating means comprises:

- a recessed surface in said plate extending parallel to said support surface;
- a beveled surface in said plate extending between said support surface and said recessed surface;
- a gate structure, under which the individual sheets of sheet-like material are fed, extending parallel to and above said beveled surface, said gate structure being located sufficiently close to said plate that the natural flexure of the second lowermost sheet of said stack when extending over said beveled surface brings the leading edge of said second lowermost sheet into abutting relation with said gate structure;
- a plurality of ports disposed in said beveled surface; suction means for selectively applying a suction force at said ports sufficient to bring a portion of the lowermost sheet of said stack when extending over said beveled surface into engagement therewith.

9. The picker mechanism of claim 8 wherein said suction means includes control means for providing the suction at said ports when said hollow member is in said second position and for removing the suction from said ports at a predetermined time after said hollow member assumes said first position, said predetermined time being sufficient to permit at least the leading edge of a sheet delivered from said stack to pass beneath said gate structure.

10. The picker mechanism of claim 8 wherein: said means for developing a partial vacuum in the hollow region of said hollow member comprises a suction pump and fluid conducting means connected between said hollow region and a fluid input port on said pump; and said suction means comprises a venturi tube connected to said fluid exhaust port of said pump, said venturi tube having a restricted throat which communicates with the fluid ports disposed in said beveled surface of said plate.

11. The picker mechanism of claim 10 wherein said surface of said hollow member is beveled at the end thereof which is remote from the direction in which said sheet-like material is fed, the degree of bevel being sufficient to substantially reduce friction between said belts and said surface of said hollow member.

12. The picker mechanism of claim 3 wherein said surface of said hollow member is beveled at the end thereof which is remote from the direction in which said sheet-like material is fed, the degree of bevel being suffi-

cient to substantially reduce friction between said belts and said surface of said hollow member.

13. The picker mechanism of claim 2 further comprising gating means for receiving said individual sheets from said stack and for preventing simultaneous passage therethrough of more than one sheet.

14. The picker mechanism of claim 13 wherein said gating means includes a plurality of fluid ports disposed in said plate, selectively actuatable suction means communicating with said ports for separating the lowermost sheet from overlapping sheets in the region of said gating means.

15. The picker mechanism of claim 14 wherein said means for developing a partial vacuum in said hollow region comprises a suction pump having a fluid inlet port and a fluid exhaust port, and fluid conducting means connected between said inlet port and said hollow region, and wherein said suction means comprises:

- a venturi tube having a restricted throat portion;
- means connecting said venturi tube to said fluid exhaust port so as to conduct exhaust fluid from said pump;
- fluid passage means connected between said throat and the fluid ports in said plate for developing a suction force at said fluid ports only when said suction pump is exhausting fluid through said venturi tube.

16. The picker mechanism of claim 13 wherein said gating means includes:

- a recessed surface in said plate extending parallel to said support surface;
- a beveled surface in said plate extending between said support surface and said recessed surface;
- a gate structure, beneath which the individual sheets are to be fed, extending above and parallel to said beveled surface;
- wherein the slope of the beveled surface is sufficiently great and the distance between said gate structure and said beveled surface sufficiently small that the natural flexure of the second lowermost sheet of said stack when extended over said beveled surface is insufficient to permit passage thereof beneath said gate structure and along said beveled surface;
- and means for drawing the leading edge of the lowermost sheet of said stack when extending over said beveled surface into engagement therewith.

17. The picker mechanism of claim 16 wherein the distance between said gate structure and said beveled surface is greater than the width of one of said sheets but smaller than the width of two of said sheets.

18. The picker mechanism of claim 17 wherein said means for drawing comprises:

- a plurality of ports disposed in said beveled surface;
- means for selectively applying a suction force at said ports.

19. The picker mechanism of claim 18 wherein said means for developing a partial vacuum in said hollow region comprises a suction pump having a fluid inlet port and a fluid outlet port, and fluid conducting means connected between said inlet port and said hollow region, and wherein said means for selectively applying a suction force at said ports comprises:

- a venturi tube having a restricted throat portion;
- means connecting said venturi tube to said exhaust port for conducting exhaust fluid therefrom;
- fluid passage means connected between said throat and the ports disposed in said beveled surface for developing a suction force at said ports only when said suction pump is exhausting fluid through said venturi tube.

20. The picker mechanism of claim 13 further comprising drive means for receiving individual sheets passing through said gating means and for applying a net force to said individual sheets for simultaneously driving and aligning said sheets in the feed direction.

21. The picker mechanism of claim 20 wherein said

15

drive means comprises two pairs of drive rollers positioned to receive opposing longitudinal edges of said individual sheets, one pair being located slightly closer to said gating means than the other pair.

22. A picker mechanism, for delivering individual sheets of sheet-like material to a transport path, of the type comprising a support plate having a first surface along which said individual sheets are fed, said mechanism further comprising:

a second surface in said support plate extending in a plane which is parallel to said first surface and located further from said stack in the direction in which said cards are fed than said first surface;

a beveled surface in said support plate joining said first and second surfaces, the slope of said beveled surface being sufficiently great such that the natural flexure of a sheet which overhangs said beveled surface is insufficient to bring said sheet into contact with said beveled surface;

a gate structure extending parallel to said beveled surface at a sufficiently close distance thereabove to block further passage of the uppermost of two overlapped sheets overhanging said beveled surface.

23. The picker mechanism of claim 22 further comprising:

means for drawing the leading edge of an individual sheet overhanging said beveled surface into engagement therewith so as to permit passage of said individual sheet beneath said gate structure.

24. The picker mechanism of claim 23 wherein the distance between said gate structure and said beveled surface is greater than the thickness of one but less than the thickness of two of said individual sheets.

25. The picker mechanism of claim 24 wherein said means for drawing provides a suction force at the underside of the lowermost sheet of said stack in synchronization with the delivery of said lowermost sheets from said stack such that only the leading edge of the lowermost sheet is subjected to the suction force.

26. The picker mechanism of claim 24 wherein said means for drawing includes:

a plurality of fluid ports disposed along said beveled surface;

means, synchronized with the delivery of individual sheets from said stack, for selectively applying a suction force at said plurality of fluid ports, said suction force being applied to said sheets only at the leading edges thereof.

27. The picker mechanism of claim 26 further comprising drive means positioned to receive individual sheets passing beneath said gate structure for simultaneously driving said sheets along said transport path and correcting the alignment of said sheets relative thereto.

28. The picker mechanism of claim 27 wherein said drive means comprises two pairs of drive rollers, positioned on opposing transverse sides of said transport path so as to receive opposing longitudinal edges of said sheets, and off-set with respect to their longitudinal position in the transport path such that one pair of rollers receives said sheets at a time shortly before the other pair.

29. The picker mechanism of claim 22 further comprising drive means positioned to receive individual sheets passing beneath said gate structure for simultaneously driving said sheets along said transport path and correcting the alignment of said sheets relative to said transport path.

30. The picker mechanism of claim 29 wherein said drive means comprises two pairs of drive rollers, positioned on opposing transverse sides of said transport path so as to receive respective opposing longitudinal edges of said sheets, and positioned in off-set relationship with respect to their longitudinal location along the transport path such that one pair of rollers normally receives said sheets at a time slightly prior to the other pair of rollers.

31. A picker mechanism of the type which delivers in-

16

dividual sheets from a stack of sheet-like material to a sheet transport path having means for driving said individual sheets while aligning them with respect to said transport path said means comprising:

a first drive means positioned along one side of the transport path to receive a first longitudinal edge of said individual sheets for delivering a force to said first longitudinal edge in the direction in which said cards are delivered;

second drive means positioned along a side of said transport path transversely opposite to said one side to receive a second longitudinal edge of said individual sheets for delivering a force to said second longitudinal edge in the direction in which said cards are delivered;

wherein said first drive means and said second drive means are off-set with respect to their longitudinal position along the transport path.

32. The picker mechanism of claim 31 wherein said first drive means comprises a first pair of drive rollers and said second drive means comprises a second pair of drive rollers, and wherein the off-set longitudinal position of said pairs of rollers is less than the length of individual ones of said sheets.

33. The picker mechanism of claim 32 additionally comprising:

feed initiating means for removing individual sheets from said stack and feeding said individual sheets toward said first and second drive means, said feed initiating means including pusher means for selectively applying a longitudinally directed force along a surface of said individual sheets being removed, and further including first suction means for drawing said individual sheets into engagement with said pusher means during the application of said longitudinally directed force.

34. The picker mechanism of claim 33 further comprising:

a gate structure disposed in the path of said individual sheets to permit passage of only the lowermost sheet of said stack to said first and second drive means; second suction means for selectively drawing the lowermost of said stack substantially away from said gate structure.

35. The picker mechanism of claim 34 wherein said second suction means is synchronized with said first suction means so as to draw only the leading edge of said lowermost sheet away from said gate structure.

36. The picker mechanism of claim 34 wherein said first suction means comprises a suction pump having a fluid inlet port and a fluid exhaust port, and means connecting said fluid inlet port to said feed initiating means such that the pump draws on ambient fluid when said longitudinally directed force is not being delivered to said surface and on a substantially evacuated region when said longitudinally directed force is being delivered thereto; and wherein said second suction means comprises a venturi tube having a restricted throat portion, said venturi tube being connected to conduct exhaust fluid from said fluid exhaust port to an ambient pressure region, and means connected to said throat portion for delivering a suction force to said individual sheets only when said venturi tube is conducting substantial exhaust fluid to the ambient pressure region.

37. The picker mechanism of claim 36 wherein the fluid capacity of said first suction means is sufficiently great to enable said pump to continue exhausting fluid therefrom immediately after application of said longitudinally directed force until the leading edge of said lowermost sheet is fed beneath said gate structure.

38. A picker mechanism for delivering individual sheets from a stack of sheet-like material to a transport path comprising:

feed initiating means for removing individual sheets

17

from said stack and feeding said sheets towards the transport path;

gating means located between said stack and said transport path for selectively separating overlapped sheets fed by said feed initiating means and for permitting passage of only a single sheet from said stack to said transport path;

synchronization means for actuating said gating means for a predetermined period of time after removal of a sheet from said stack, said predetermined period of time being sufficient to permit passage of the leading edge of the lowermost of said overlapped sheets beyond said gating means to said transport path;

wherein said synchronization means includes: suction pump means for delivering a partial vacuum to the lowermost sheet in said stack so as to bring said lowermost sheet into engagement with said feed initiating means as said lowermost sheet is being removed from said stack, and for drawing on an ambient pressure fluid when an individual sheet is not being removed from said stack;

venturi tube means connected to said pump means for conducting exhaust fluid therefrom to an ambient pressure region;

fluid conducting means connected between said gating means and said venturi tube means for developing a suction force on a surface of said lowermost sheet as it is fed to said gating means.

39. The picker mechanism of claim 38 further comprising a plate having a first surface on which said stack is supported and a second surface parallel to said first surface and recessed slightly therefrom along which said individual sheets travel upon passage through said gating means, and wherein said gating means includes:

a gate structure extending above the juncture between said first and second surfaces and disposed to block passage of all but the lowermost sheet of said stack from said first to said second surfaces;

a plurality of ports extending through said plate at the juncture between said first and second surfaces, said ports communicating with said fluid conducting means so as to develop said suction force on an

18

individual sheet overhanging the juncture between said surfaces such that said individual sheet may be brought into engagement with said second surface.

40. A picker mechanism for feeding individual sheets from a stack of sheet-like material, portions of said sheetlike material being suitable for containing coded data in the form of perforations therein, said mechanism being of the type comprising a plate having a support surface for supporting said stack of sheet-like material, said plate having at least one slot extending therethrough to permit selective engagement of the lowermost sheet in said stack by driving means, said driving means having at least one aperture extending therethrough and in alignment with an unperforated portion of said sheet-like material, feed initiating means for selectively moving said driving means into engagement with said lowermost sheet and for developing a suction at said lowermost sheet through said at least one aperture, whereby said lowermost sheet is removed from said stack in a direction in which said driving means is driven, the improvement comprising:

at least a second aperture extending through said driving means and disposed adjacent said at least one aperture and in alignment with a portion of said sheet-like material which is suitable for containing perforations;

means for venting the space contiguous to said portion of sheet-like material which is suitable for containing perforations through at least said second aperture in said driving means when said driving means is in engagement with said lowermost sheet.

References Cited

UNITED STATES PATENTS

2,819,078	1/1958	Durand	271—52	X
2,956,802	10/1960	Huck	271—26	X
3,126,201	3/1964	Rehm	271—32	
3,212,772	10/1965	Ward	271—32	

FOREIGN PATENTS

344,611 11/1936 Italy.

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