United States Patent

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[54] **CARD-READING MECHANISM**
12 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** ..... **235/61.11 B**
[51] **Int. Cl.** **G06k 7/04**
[50] **Field of Search** ..... 235/61.11, 61.111, 61.112, 61.113, 61.114; 271/52; 209/DIG. 2; 194/4; 222/2; 179/100.2 MI; 340/174.1 C

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ABSTRACT: A mechanism for reading encoded data on a strip on credit cards of varying sizes and formats as the cards are passed through a slot past a transducer, the strip on each card being positioned on a flat surface of the card along a longitudinal edge thereof. The mechanism has two spaced walls defining the slot and spaced to receive all of the cards loosely, and has a guide wall against which the locating edge of the cards is pressed. A pair of rollers engage opposite sides of the card alongside the strip, one roller locating the flat surface in a reference plane for engagement of the strip with a working face of the transducer that is positioned beside the reference plane. A pressure pad holds the strip against the working face and yieldable edge guides hold the locating edge firmly against the locating edge. For simplicity of assembly and disassembly, the various elements are mounted in two subassemblies on channellike pieces held in back-to-back spaced relation on opposite sides of the card slot by quick-release connectors.

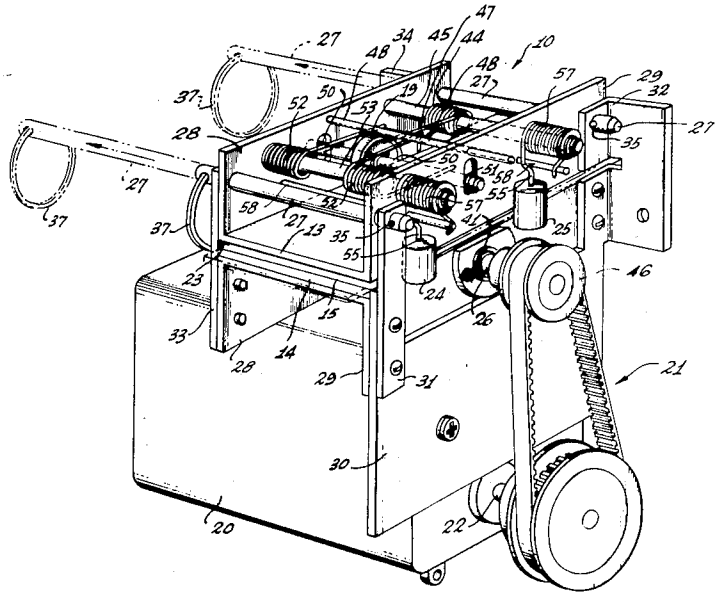


Fig. 1

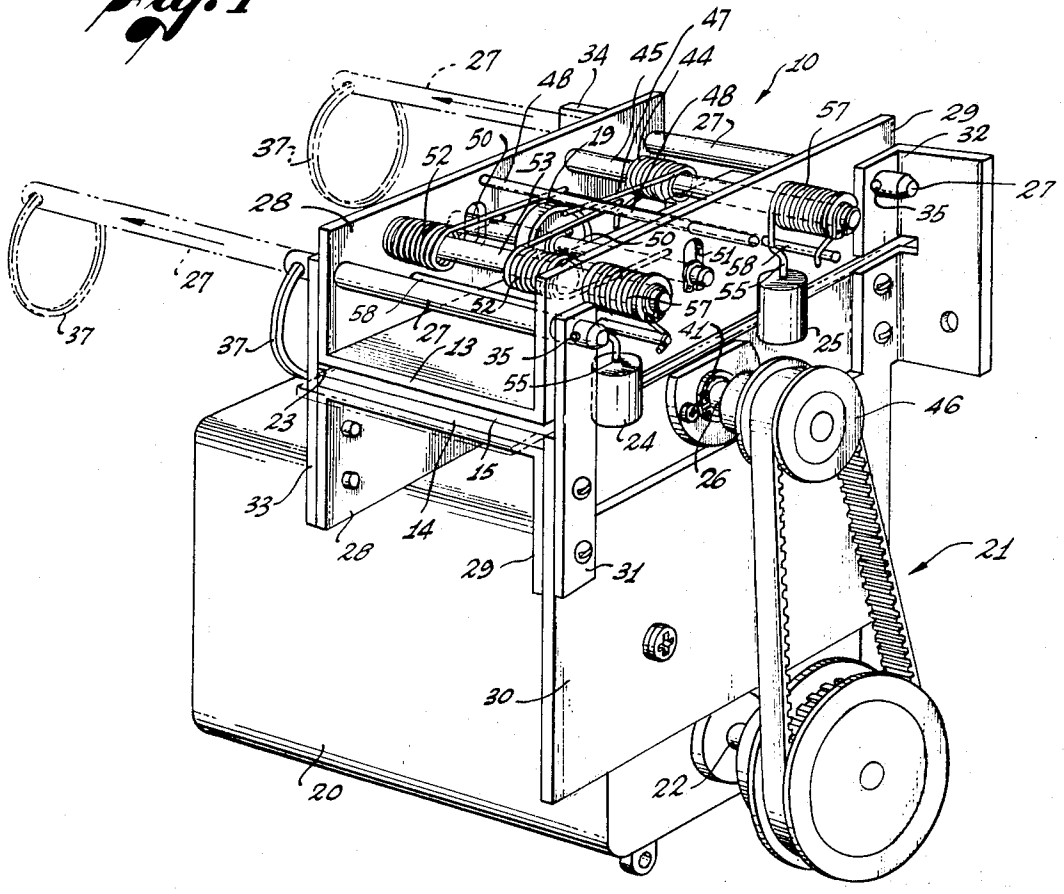
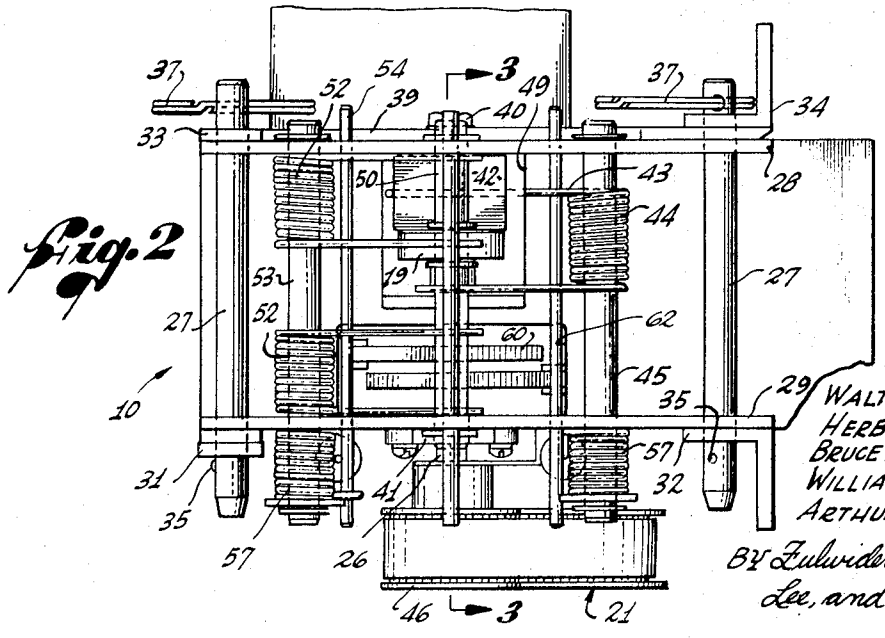


Fig. 2



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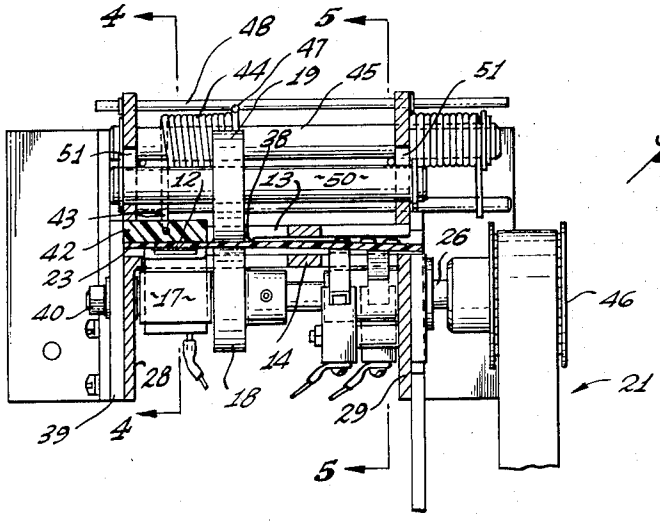


Fig. 3

Fig. 4

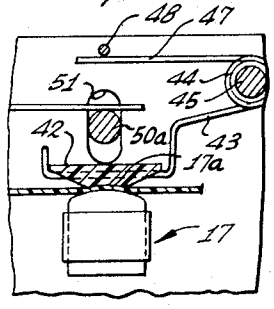
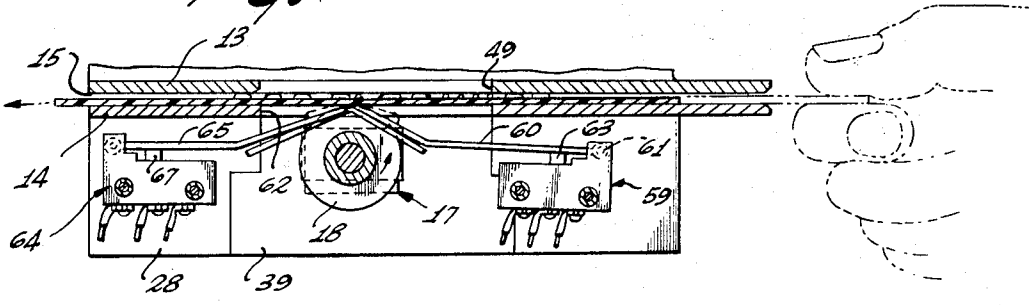


Fig. 5



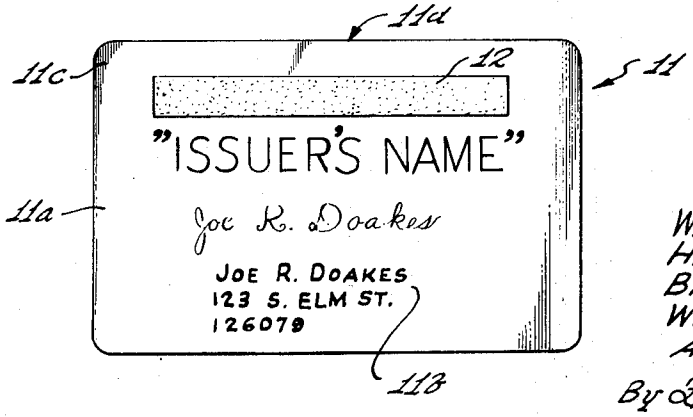


Fig. 6

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CARD-READING MECHANISM

BACKGROUND OF THE INVENTION

The present invention relates generally to mechanisms for reading encoded characters and, more particularly, to a mechanism for reading encoded characters on a strip on a credit card.

As computer applications have been extended more and more into everyday life, it has become possible to automate many relatively simple clerical functions. Among them is the use of credit cards for purchases. Instead of recording the purchase in the usual manner with names, account numbers and dollar amounts of purchases, which must later be converted into data acceptable by a computer, it is possible to record the purchase directly in terms acceptable by a computer by means of appropriate terminal equipment at the place of purchase.

To facilitate credit card purchases, the information ordinarily printed or embossed on the card, such as the customer's name, address and account number, may also be encoded on a strip somewhere on the card itself so that a card-reading mechanism may be employed at the time of purchase to read the information contained on the strip, using a sensing head or transducer of basically conventional construction. In this way, a purchase is less time consuming and the only variable which need be considered is the amount of purchase.

However, in order for such a credit card system to be feasible, the terminal equipment which reads the information on the strip of the credit card must be comparatively inexpensive, as such equipment has to be practically as numerous as the simple stamping equipment conventionally used. Also, the card-reading mechanism of the terminal equipment should be able to read information from the strips on a number of different types of credit cards in a reliable manner despite variations in size of the cards.

SUMMARY OF THE INVENTION

The present invention resides in a relatively simple, compact, durable and inexpensive mechanism for receiving a credit card having a size within a permissible range of sizes, and reliably reading encoded data on a strip on the card as the latter is fed through the mechanism, all in a quick and simple operation. Moreover, the mechanism accurately positions each card relative to the transducer, positively maintains each strip in intimate contact with the transducer during reading, and is easily assembled and subsequently partially disassembled for routine maintenance.

To these ends, the illustrative embodiment of the card-reading mechanism defines an open-ended slot that is bounded on opposite sides by substantially parallel walls for guiding each card into and through the slot, with sufficient clearance to accommodate a range of card sizes and thicknesses, and locating elements are provided to hold one longitudinal edge portion of each card, regardless of the size of the card, in a predetermined lateral relation with a transducer while the card is in the slot. The transducer is mounted on one side of the slot to be aligned with the located edge portion of the card for engagement with the strip on that edge portion, and a simple pressure pad urges the card, and thus the strip, into firm engagement with the transducer.

In addition, a drive roller assembly receives the card as it is inserted in the slot and cooperates with the guide elements in feeding the card past the transducer while holding the strip in a proper plane for engagement with the transducer. The drive roller assembly is positioned to engage a flat portion of the card along the edge portion carrying the strip, and thus allows the opposite edge portion to remain free to flex within the slot as needed to accommodate embossed information on that portion. The drive roller assembly is power driven and may be actuated for automatic card-feeding in response to insertion of a card.

For ease of maintenance, the card-reading mechanism is formed by a two-piece frame held detachably together by quick-release connectors, each piece of the frame forming one side of the slot and preferably being a channellike piece with the basic components on each side of the slot within the channel and projecting through the bottom thereof into the card slot. When the connectors are removed, the two pieces are separable for ready access to all parts of the mechanism.

Other objects and advantages of the card-reading mechanism will become apparent from the following detailed description, taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a card-reading mechanism embodying the novel features of the present invention, shown with an associated motor and pulley assembly, the quick-release pins being shown removed in phantom;

FIG. 2 is a fragmentary plan view of the card-reading mechanism of FIG. 1;

FIG. 3 is a fragmentary sectional view taken along the line 3—3 of FIG. 2;

FIG. 4 is a fragmentary sectional view taken along the line 4—4 of FIG. 3;

FIG. 5 is a fragmentary sectional view taken along the line 5—5 of FIG. 3; and

FIG. 6 is an elevational view of a representative credit card, with a magnetic strip thereon, suitable for use in the transport mechanism of the present invention.

DETAILED DESCRIPTION

As shown in the drawings for purposes of illustration, the invention is embodied in a card-reading mechanism **10** for receiving a credit card **11** and reading encoded data from a magnetic strip **12** on the card as the latter is passed through the mechanism. For this purpose, the mechanism includes a frame having a pair of spaced, parallel walls **13** and **14** defining a slot **15** for receiving a card, a transducer **17** supported on the frame on one side of the slot for engagement with the magnetic strip as the card passes, a pair of rollers **18** and **19** mounted on opposite sides of the slot to engage opposite sides of the card and feed the latter past the transducer, and an electric motor **20** upon which the mechanism is mounted and by which the mechanism is driven through a pulley assembly **21** connecting the output shaft **22** of the motor to a parallel shaft **26** carrying one of the rollers, herein the lower roller **18**.

Most credit cards are of approximately the same size and thickness, and have generally similar formats, as illustrated in FIG. 6. The name of the issuer of the card typically is printed on the central portion **11***a* of the front side, and identifying information regarding the purchaser, including his name and account number, is embossed on the card in the area **11***b* beneath the issuer's name so that the card can be used in the conventional manner to stamp this information on a sales slip. This leaves the upper portion **11***c* free of embossing and available for mounting of a magnetic strip **12** extending along, and parallel to, the upper longitudinal edge **11***d* of the card.

To facilitate handling of credit cards of different sizes and thicknesses, and to accommodate cards with specifically different patterns and thicknesses of embossing in the area **11***b* of the card, the present invention contemplates a card-reading mechanism **10** for positioning each card in the slot with the magnetic strip **12** in a precisely located plane and lateral position relative to the transducer **17** as an incident to insertion of the card in the slot **15**, and despite the aforementioned variations in different cards. More specifically, cards for use with the present invention have magnetic strips **12** that are located a preselected distance from the upper edge **11***d* and in laterally spaced relation with the embossed area **11***b* so as to leave a flat surface area **11***a* between the strip and the embossing. The mechanism uses the edge **11***d* and the flat central surface area **11***a* as the locating surfaces for the card, thus

rendering unimportant any variations in size, thickness and embossing within a normal range of such variations and insuring accurate alignment and firm contact between the strip 12 and the transducer 17 for reliable reading. Moreover, this important result is achieved in a simple, compact and relatively inexpensive mechanism which can be quickly and easily disassembled for routine maintenance.

To the foregoing ends, the slot walls 13 and 14 are spaced apart to receive all cards within the normal range of sizes with loose fit, both edgewise in the plane of the card and broadwise or vertically as viewed in FIG. 1, and a locating wall 23 is provided along one side edge of the slot for sliding engagement with the locating edge 11*d* of each card. Laterally yieldable elements, herein spring-biased edge rollers 24 and 25, press the card firmly against the locating wall 23 while being yieldable to accommodate cards of different widths, and the lower roller 18 is positioned on the frame with its surface below and tangent to a preselected reference plane extending through the slot so that the roller engages the flat central area 11*a* of the card alongside the magnetic strip 12. In this manner, the lower roller 18 locates both the central area and the magnetic strip relative to the reference plane. The transducer 17 has a working face 17*a* beside the roller 18 and is accurately located relative to the reference plane for firm engagement with the magnetic strip when the flat surface 11 *a* is against the roller, and means are provided for yieldably urging the magnetic strip against the transducer and the flat surface area against the roller as the card passes, while permitting the embossed area 11*b* to bow and adapt itself to the card slot independently of the accurate positioning of the strip within the slot.

For ease of disassembly, the frame is formed in two main subassemblies that are disposed on opposite sides of the card slot 15 and are joined together by quick-release connectors 27 which, when removed, permit the subassemblies to be separated along a parting plane extending through the slot. As shown most clearly in FIG. 1, the two frame subassemblies are mounted on channellike frame pieces of generally U-shaped cross section disposed in back-to-back relation with the bottom walls of the channels spaced apart and constituting the walls 13 and 14 of the slot. Each channel includes two flanges 28, 29 extending away from the slot from the side edges of the bottom wall 13, 14, and the lower subassembly has a mounting bracket 30 depending from one side and fastened to the motor 20, and tie bars 31, 32, 33 and 34 fastened to both of its sides and extending upwardly alongside the upper subassembly. These tie bars are formed with holes that are aligned with similar holes in the flanges of the upper subassembly, and the quick-release connectors 27 are pins inserted through the aligned holes and held releasably in place by spring-loaded balls 35 at one end and pull-rings 37 at the other.

The lower frame subassembly carries the transducer 17 and the roller 18, as shown most clearly in FIG. 3, beneath the left-hand portion of the card slot 15 and both projecting upwardly through the slot wall 14 in a cutout 38 therein. Herein, the transducer is supported on a side plate 39 integral with the tie bar 33 on the left side and covering a portion of the cutout 38 that extends into the side flange 28, the transducer being of conventional construction and mounted on a bolt 40 extending through the side plate. The roller 18 is supported beside the transducer on the shaft 26, which preferably is journaled in a bearing 41 fast in the opposite flange 29 to hold the shaft for rotation about a fixed axis parallel to the planes of the slot walls 13 and 14. On the outer end of this shaft is a pulley 46 driven by the motor 20 to feed cards through the slot.

The working face 17*a* of the transducer 17 is disposed beside the reference plane, which is spaced above the lower slot wall 14 within the card slot 15 and below the other slot wall 13 a distance at least as great as the maximum thickness of cards within the acceptable range. The upper side of the roller 18 is substantially tangent to the same reference plane to locate the front side of the card in the reference plane and thereby cooperate with the transducer in locating the strip 12 relative to the plane. Preferably, the roller has a peripheral covering of relatively firm, resiliently compressible material, such as rubber, forming a rim for cushioned, gripping engagement with cards, so the roller may extend slightly above the reference plane when no card is in the mechanism.

To hold the strip 12 firmly against the transducer 17, a pressure pad 42 (FIGS. 2, 3 and 4) is supported on the upper subassembly above the transducer on a spring arm 43 constituting an integral extension of a spring coil 44 telescoped over a mounting pin 45 spanning the upper flanges 28 and 29, the coil having a second extension 47 extending under a retainer pin 48 and being stressed to urge the pressure pad 43 downwardly through a cutout 49 in the upper slot wall 13 and toward the transducer. Although it is possible to use a transducer with a flat working face, the transducer 17 herein has a convexly curved face 17*a* shown most clearly in FIG. 4, and the underside of the pressure pad, which herein is a piece of suitable plastic with the free end portion of the spring arm 43 embedded therein, has a corresponding concave curvature so as to conform each credit card 11, and the magnetic strip 12, to the curvature of the working face. This is made possible by the inherent flexibility of the materials used for most credit cards.

The second drive roller 19, which also has a rubber rim, is mounted on the upper subassembly above the roller 18 and is yieldably urged downwardly through the cutout 49 to hold credit cards firmly against the lower roller. For this purpose, the upper roller is supported on a transverse shaft 50 (FIGS. 1–4) having opposite ends extending through aligned, vertically elongated slots 51 in the upper flanges 28 and 29, and two springs 52 are coiled around a parallel mounting pin 53 extending between the upper flanges with one free end portion of each spring disposed beneath the retainer pin 48 between the flanges and with the other free end portion of each spring overlying the roller shaft 50, both springs being stressed to press the shaft downwardly and hold the roller 19 against each card passing through the card slot 15. The mounting slots 51 preferably fit the shaft 50 snugly to eliminate horizontal play while permitting free up-and-down motion.

As will be seen in FIGS. 1 and 3, the locating wall 23 for abutting against the edge 11*d* of the card 11 in the slot 15 herein is formed by the inner side of the side plate 39, including the integral tie bar 33 thereon, where these elements extend across the left side of the card slot as viewed in FIGS. 1 and 3. The rollers 24 and 25 for holding each card firmly against this wall despite variations in width from one card to another, are spaced apart along the opposite open side of the card slot and are biased toward the locating wall 23 by means of generally vertical spring arms 55 (FIG. 1) which depend from two spring coils 57 telescoped onto the protruding ends of the pins 45 and 53 outside the upper flange 29. Each of these coils has one free end portion that is hooked around one side of a retaining pin 58 spanning the upper flanges, and has a second end portion extending downwardly on the other side of the associated retaining pin and forming the spring arm for an edge roller. Adjacent the retaining pin, each arm is offset outwardly and then bent downwardly into the associated edge roller so that the latter is pressed lightly against the aligned outer sides of the upper and lower channels, across the open side of the card slot.

In this manner, each edge roller 24, 25 initially is spaced a selected distance from the locating wall 23, the distance being at least as small as the narrowest card in the acceptable range, and each roller is yieldable outwardly far enough to accommodate the widest card in the range. Accordingly, all cards are pressed firmly against the locating wall while passing through the card slot.

It should be noted that the rollers 18 and 19, the pressure pad 42, the edge rollers 24 and 25, and the associated spring coils 52, 44 and 57, all are mounted simply and compactly on the two frame subassemblies on pins quickly and easily assembled between the two pairs of flanges 28 and 29. Simple C-shaped snap rings fitted in grooves around the pins outside the flanges hold the pins in place for economy of construction and ease of assembly.

Although the motor **20** may be turned on to drive the roller **18** continuously while the card-reading mechanism **10** is in use, herein a microswitch **59** (FIGS. **2**, **3** and **5**) is incorporated in the mechanism to activate the motor automatically in response to the insertion of a credit card **11** in the card slot **15**. For this purpose, the microswitch is mounted on one of the lower flanges **28** beneath the card slot with a leaf-type actuator arm **60** pivoted at **61** on the microswitch and inclined upwardly through another cutout **62** in the lower slot wall **14** to extend across the path of entry of a card into the slot. Thus, the leading edge of each card engages the actuator arm and presses the same downwardly so that the arm depresses a switch button **63** on top of the microswitch, closing the latter to complete an energizing circuit for the motor. The motor then drives the shaft **23** through the pulley assembly **21** to turn the roller **18** forwardly, in the direction indicated by the arrow in FIG. **5**, until the card clears the actuating arm and releases it to open the switch.

When this occurs, the card **11** projects to the left beyond the left end of the mechanism **10** as shown in FIG. **5**, and thus may be removed simply by pulling it on through the slot **15**. In some instances, however, it is desirable to provide for both insertion and removal from the same side, the right side in FIG. **5**. This may be accomplished simply by using a reversible motor and providing switching elements (not shown) for reversing the motor in response to movement of a card past the transducer but before the card clears the drive rollers **18** and **19**.

Improved performance of the transducer **17** is obtained if the transducer is deenergized when inactive and then is turned on as in incident to the insertion of a card. For this purpose, a second microswitch **64** is provided in the mechanism with an actuating arm **65**, similar to the arm **60**, projecting upwardly through the cutout **62** to be engaged by the card **11** at the proper instant during insertion of the card in the slot **15**. Downward movement of this arm depresses a button **67** for actuating the transducer microswitch, the latter being mounted on the lower flange **28** on the opposite side of the transducer from the microswitch **59**, as shown in FIG. **5**.

From the foregoing, it will be evident that the present invention provides an effective and relatively inexpensive card-reading mechanism which is capable of reading encoded data on magnetic strips on credit cards of varying sizes and formats while positioning each magnetic strip accurately in the mechanism and relative to the transducer for proper engagement of the strip with the transducer. By positioning the strip on a flat portion of the card relative to the adjacent longitudinal edge and then using the locating wall **23** and the drive roller **18** to position the flat side portion of the card relative to the transducer, variations in thickness and width are rendered unimportant. At the same time, the card slot is made wide enough to accommodate the embossing on the other side of the drive rollers with a loose fit having no effect on the positioning of the magnetic strip. In addition, the mechanism is of simple, durable and compact construction and is easily disassembled for routine maintenance simply by pulling the quick-release connectors **27** to separate the two frame subassemblies. It also will be apparent that, while a specific embodiment has been illustrated and described, various modifications may be made without departing from the spirit and scope of the invention.

We claim as our invention:

1. Mechanism for reading data encoded on a strip on a credit card and located along a first edge of the card between the edge and a central portion of the card, the card having a width within a selected range and being of uniform thickness from the first edge through the central portion and of varying thickness thereafter to a second edge of the card opposite said first edge, said mechanism having, in combination:

two spaced and generally parallel slot walls defining a card slot between them wider than the maximum thickness of the card to receive the card loosely in said slot;

a locating wall extending along one side of said slot;

means on the other side of said slot for urging the card toward said locating wall and yielding to accommodate cards of different widths;

a transducer projecting into said slot through one of said slot walls adjacent said locating wall and having a working face disposed alongside a predetermined reference plane within said slot, said reference plane being spaced from the other of said slot walls a distance at least as great as the thickness of the card from the first edge through the central portion thereof;

a positioning element projecting into said slot through said one slot wall and having a surface lying alongside said plane, and positioned to engage the central portion of the card;

and means projecting into said slot from said other slot wall and yieldably urged toward said transducer and said positioning element for holding the card firmly with said strip against said working face and the central portion in said plane despite variations in the thickness of the card.

2. Mechanism as defined in claim **1** in which said transducer and said element are supported in side-by-side relation with said transducer between the element and said locating wall, said transducer being spaced from the locating wall a distance equal to the distance the strip is spaced from the card edge and said element being located substantially immediately adjacent to said transducer.

3. Mechanism as defined in claim **2** in which said means for urging the card toward said locating wall comprise rollers along said other side and across said slot which are spring-biased toward said locating wall.

4. Mechanism as defined in claim **2** in which said positioning element is a roller mounted for rotation about a fixed axis with its peripheral surface substantially tangent to said plane, whereby the central portion and strip of the card are located in said plane as the card passes through said mechanism.

5. Mechanism as defined in claim **4**, in which:

said working face is convexly curved; and

said means for holding the card against said working face and the flat central portion in said plane includes a pressure pad substantially opposite said working face and spring-biased toward the latter, said pressure pad having a concave curvature corresponding to said working face.

6. Mechanism as defined in claim **5** in which said means for holding the card against said working face and the flat central portion in said plane includes a second roller substantially opposite said positioning roller and spring-biased toward the latter, one of said rollers being power driven to feed the card past said transducer.

7. Mechanism for reading data encoded on a strip on a credit card and located along an edge of the card between the edge and a flat central portion of the card, and the card having a width and thickness within a selected range, said mechanism having, in combination:

two spaced and generally parallel slot walls defining a card slot between them wider than the thickness of the card to receive the card loosely in said slot;

a locating wall extending along one side of said slot;

means on the other side of said slot for urging the card toward said locating wall and yielding to accommodate cards of different widths;

a transducer projecting into said slot through one of said slot walls adjacent said locating wall and having a working face disposed alongside a predetermined reference plane within said slot and spaced from the other of said slot walls a distance at least as great as the thickness of the card, said transducer being spaced from the locating wall a distance equal to the distance the strip is spaced from the card edge;

a positioning element projecting into said slot through said one slot wall and having a surface lying alongside said plane, and positioned to engage the flat central portion of the card, said transducer and said element being supported in side-by-side relation with said transducer between the element and said locating wall;

means projecting into said slot from said other slot wall and yieldably urged toward said transducer and said positioning element to hold the card firmly with said strip against said working face and the flat central portion in said plane despite variations in the thickness of the card; and

a frame comprising two subassemblies, each including a channellike frame piece with a bottom wall forming one of said slot walls, and further including quick-release connecting means holding said subassemblies releasably together for separation along a parting line in said slot.

8. Mechanism as defined in claim 7 in which said connecting means includes tie bars on said frame pieces spanning said slot, and pull pins extending through said tie bars and one of said frame pieces.

9. Mechanism as defined in claim 7 in which said positioning element and said transducer are fixedly mounted on one of said subassemblies to project through the bottom wall thereof, and said means for holding the card against said transducer are movably mounted on the other of said subassemblies to project through the bottom wall thereof.

10. Mechanism as defined in claim 9 in which said positioning element is a roller mounted for rotation about a fixed axis with its peripheral surface substantially tangent to said plane, said means for holding the card against said working face of said transducer and the flat central portion of the card in said plane includes a second roller overlying said positioning roller, said second roller being rotatably mounted of a shaft movable within slots in flange portions of said frame piece of said one of said subassemblies, said second roller being resiliently urged toward said positioning roller by first and second torsion springs telescopingly mounted on a first pin mounted between said flange portions with one spring arm of each of said first and second springs contacting said shaft and the other spring arm of each of said first and second springs being held under a retaining pin mounted between said flange portions to place said first and second springs under tension.

11. Mechanism as defined in claim 10 in which said means for holding the card against said working face of said transducer and the flat central portion of the card in said plane further includes a pressure pad overlying said working face resiliently urged toward said transducer by a third torsion spring telescopingly mounted on a second pin mounted between said flange portions, one spring arm of said third spring carrying said pressure pad and the other spring arm thereof being held under said retaining pin to place said third spring under tension.

12. Mechanism as defined in claim 11 in which said means for urging the card toward said locating wall include a pair of rollers along said other side each mounted on one spring arm of fourth and fifth torsion springs mounted on ends of said first and second pins protruding beyond one of said flange portions on said other side, said rollers thereby resiliently urging the card toward said locating wall.

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