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[54] MAGNETIC CARD READER-ENCODER

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[58] **Field of Search**.....340/174.1; 179/100.2 CA, 100.2 MD; 235/61.11 R, 61.11 A, 61.11 C, 61.11 D; 271/DIG.9

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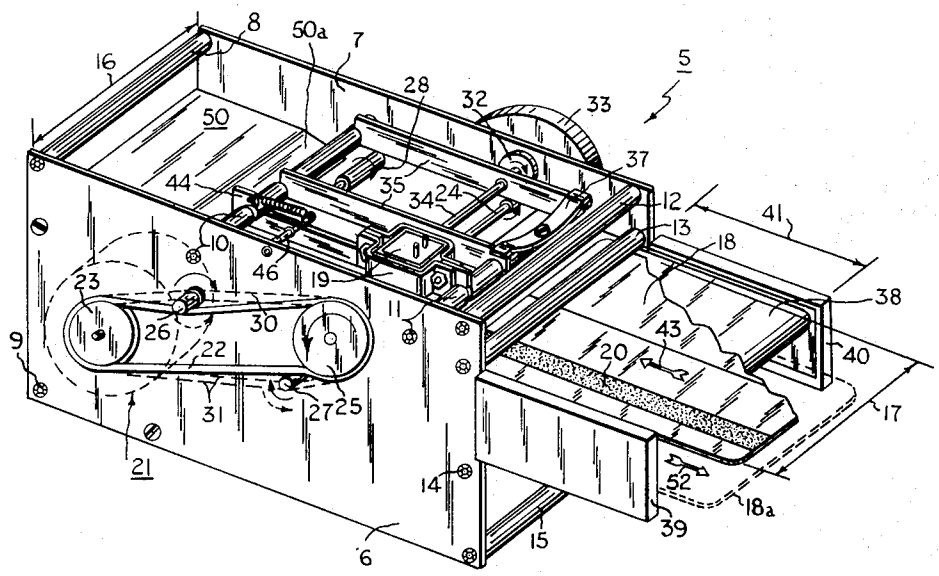
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[57] **ABSTRACT**

An improved low-wear automatic card-processing device, for machine readable cards of the type having a magnetically encoded stripe of magnetic substance, includes a non-reversing motorized belt drive for spring-biased rollers which induce a positive feed of a card past a spring-floated magnetic read-record head and which further positively convey the card to a discharge site after processing.

7 Claims, 4 Drawing Figures



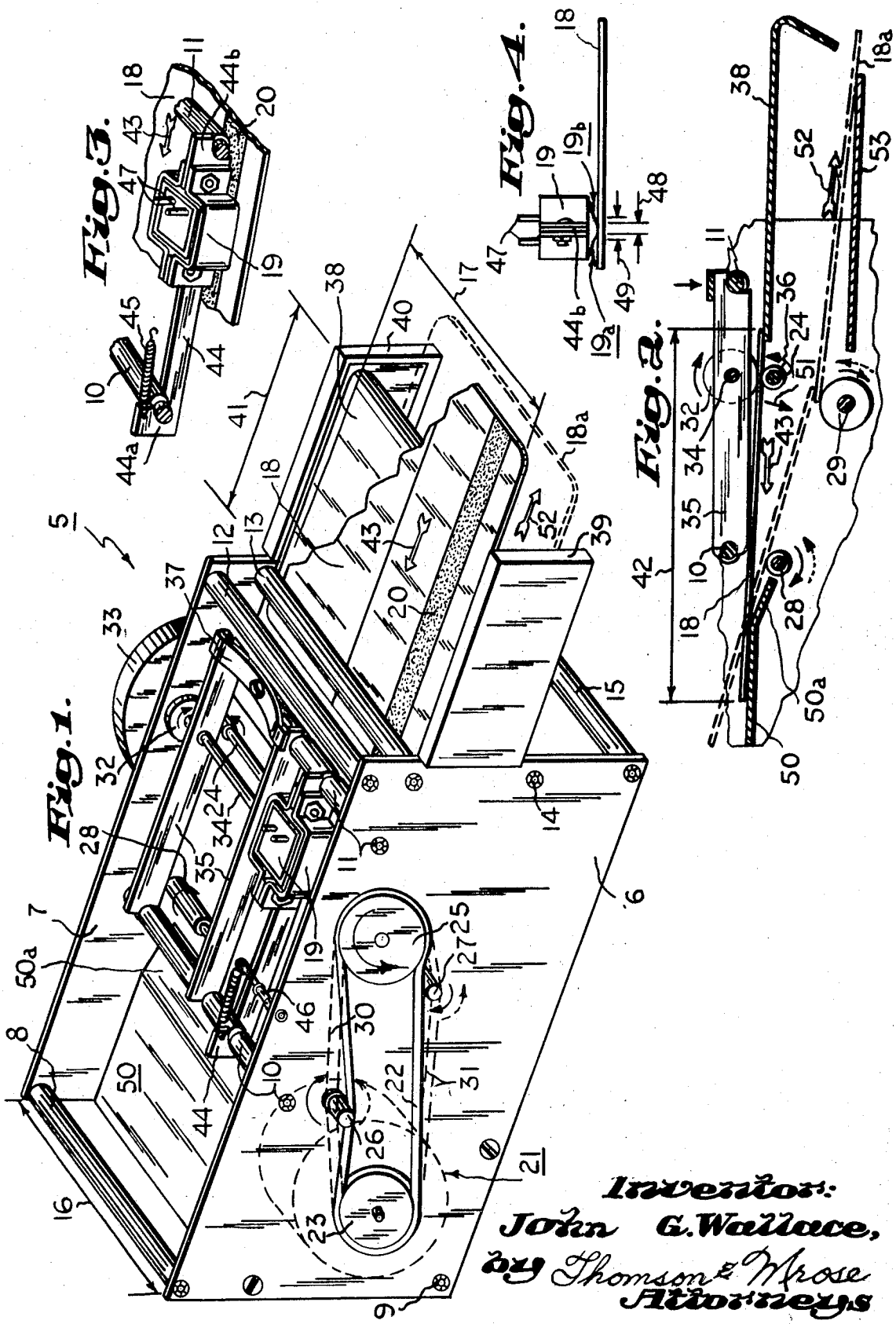


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

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MAGNETIC CARD READER-ENCODER

BACKGROUND OF THE INVENTION

The present invention relates to improvements in the automatic processing of magnetically encoded cards, such as credit cards and the like which are intended to be interfaced transiently with computer equipment, and, in one particular aspect, to novel and improved magnetic card reader-encoder devices of low-cost compact construction in which a single miniature synchronous motor cooperates with belt-operated rollers and yieldable suspensions of magnetic read-record head and card feed mechanisms to develop positive low-wear automatic mechanical transport of cards between insertion and discharge sites.

There have been numerous and varied uses of data-encoded cards as adjuncts to automatic and computerized data processing; among these are well known uses of so-called credit cards, which must be of conveniently small size and must withstand severe handling conditions. In facilitating the encoding and readout of data on cards of the latter type, and in rendering the data highly immune to accidental or wrongful alterations, magnetic material has been used in a narrow strip along a prescribed path across a surface of the card. Typically, exceedingly minute magnetic particles have been hot-stamped or silk-screened onto plastic cards to form the strip or stripe, and discrete magnetizations transversely to the stripe establish the "bits" of coding which signify each character. In both the initial encoding and subsequent readouts of the data, the supporting card and a magnetic transducer head must be moved in a predetermined relation to one another at a substantially constant rate and in a positive fashion, without injury to the card and without significant frictional abrasion and wearing of the magnetic stripe.

Card-transport mechanisms serving the aforementioned purposes are required at many convenient locations where the person to whom it is issued may wish to use it to establish identity, credit, or the like, and should therefore be of relatively inexpensive, compact and uncomplicated construction. Moreover, their important functions dictate that they be highly reliable, as well as fast-operating and entirely automatic.

SUMMARY

By way of a summary statement as to practice of this invention in one of its aspects, an improved magnetic card reader-encoder device is packaged mainly within a framework formed by a pair of metal side plates maintained in parallel narrowly spaced relation by a plurality of staked spacer rods, the plate spacing being only slightly in excess of the standard width of cards which are to be transported between them. At one upper end of the framework, a sheet-metal horizontal card guide serves to deliver hand-inserted cards to the bite between framework-mounted horizontal rollers, one of which is spring-biased to yield as a card is encountered, and the other of which is driven by a synchronous electric motor nested in a remote portion of the framework but coupled in driving relation to the card-drive roller via pulleys and a belt disposed laterally outside of the framework. The driven roller is associated with a flywheel which further stabilizes the rate at which a card is transported into the device and at which a suitably positioned electromagnetic recording/reading head may interact with a longitudinal stripe of magnetic material on one exposed surface of the card. In minimizing wear of this magnetic material, the electromagnetic head is yieldably mounted and provided with a limited amount of substantially universal freedom of motion with respect to the supporting framework. Inwardly beyond the card guide and drive rollers, the transported card gravitates into a guided engagement with a further driven roller which propels it in one or another direction to discharge out of the framework, the selected direction depending upon the selected position of the external belt in its frictional drive relation to an extension of the further roller.

It is one of the objects of the present invention to provide novel and improved automatic magnetic-card processing devices of compact and inexpensive construction which operate reliably and without undue wear of cards in transporting them for precision interaction with an electromagnetic read/record head.

A further object is to provide a unique and uncomplicated miniature mechanical card-transporting assembly wherein a single non-reversing synchronous electric motor not only powers the precision movement of credit cards or the like past an electromagnetic transducer head but also positively propels them to a discharge site.

Another object is to provide a non-mutilating magnetic card reader-encoder in which belt-driven card-feed rollers are in yieldable engagement with cards and in which a floating yieldable suspension of a transducer head minimizes card wear.

Although the features of this invention which are believed to be novel are expressed in the appended claims, further details as to preferred practices, as well as to further objects and advantages, may be most readily comprehended through reference to the following description taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective pictorial view of an improved magnetic card reader-encoder device, together with brokenaway and phantom representations of an associated card;

FIG. 2 provides a cross-sectioned side view of part of the mechanism of FIG. 1;

FIG. 3 comprises a pictorial detail of the electromagnetic transducer head and related support elements, for the same apparatus depicted in FIGS. 1 and 2; and

FIG. 4 is an end view of the same transducer head in cooperative relation to a card.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As is illustrated in FIG. 1, the improved apparatus 5 for processing data cards is developed around a mechanical framework or chassis arrangement of advantageously low-cost construction, including a pair of parallel metal side plates, 6 and 7, which are secured in a predetermined spaced relationship by a plurality of distributed spacer rods, 8 – 15, staked or otherwise suitably fastened with these side plates. The lateral spacing, 16, between the inner surfaces of plates 6 and 7 is selected to be just slightly in excess of the width 17 (typically about 2⅛ inches) of a somewhat stiff plastic data card, 18, which is to be processed through the apparatus for automatic readout or encoding. This spacing assures that the card will be properly guided later-

ally in transit through the framework, in a manner described later herein.

In its intended use, apparatus **5** receives a card, **18**, which is usually inserted manually, and is then expected to transport that card past an electromagnetic transducer head, **19**, automatically, for either recording or readout of data on a longitudinal stripe **20** of magnetic material exposed on the front side of the card. The stripe may be continuous or discontinuous, may or may not be rendered visible, and may comprise any suitable magnetic material known in the art, such as particles of magnetic material which are hot-stamped or silk-screened into bonded relation with the plastic or other material of which the card is made. Generally, the stripe **20** is a discrete long and narrow region, although, functionally, comparable results are obtainable with broader-area regions only smaller "stripe" portions of which need cooperate electromagnetically with the associate transducer head. In a typical practice, the encoding is by way of minute discrete magnetizations of the stripe material in directions transverse to the longitudinal direction of the stripe, and these binary "bits" of data may be made to characterize desired numbers, letters, or other characters, which are meaningful when processed by way of conventional computer circuitry with which the transducer head is connected. The associated circuitry and equipment of a computer with which this apparatus is used, and which may be of well-known form, may involve equipment for applying pertinent electrical encoding pulses to the transducer head, or, in the perhaps more numerous cases, for translating prior-encoded data into readouts which are informative to the operator; in the latter connection, for example, the readout may identify the owner of a credit card and, after computer comparisons with related stored data, his then-current credit standing.

For the aforesaid purposes, the card is propelled past the transducer head in a positive and controlled manner, while it is being held and simultaneously moved linearly at a substantially constant speed. Once the electromagnetic interaction with the transducer head is completed, the card must be conveyed to a discharge site where it will be readily accessible to the operator, and, depending upon installation requirements, this may require further transport movement either in the same or in the reverse direction. All of these motive requirements are advantageously satisfied by but a single miniature synchronous electric motor, **21**, outlined in dashed linework at its lower corner position between the side plates, where it will not interfere with intended card transport movements elsewhere between these plates. Rotation of certain integral rollers which transport the card is, in turn, developed by a single elastic belt, **22**, which is driven by a small motor pulley **23** located externally of one of the side plates, **6**; one of these rollers, **24**, is likewise equipped with a small external pulley, **25**, rotated by the same belt, and the external ends **26** and **27** of two further rollers **28** and **29** (FIG. **2**) are also engaged with and driven by the belt. The main span of belt **22** is between the two peripherally grooved pulleys **23** and **25**, which hold the external belt securely in place, and, at intermediate positions, the roller ends **26** and **27** engage the taut belt for rotation in one or the opposite angular direction, depending upon whether the belt has been manually deflected to engage them as shown in FIG. **1** or to engage them on their opposite sides, as shown in dashed linework **30** and **31**, respectively, in the same illustration. A flywheel **33** attached to roller **24** regulates drive power.

As viewed in FIGS. **1** and **2**, roller **24** is driven counterclockwise, and forms laterally spaced bites with overhead rollers, such as roller **32**, carried by a shaft **34** freely rotatable in yoke arms **35**. Roller **24** itself preferably carries sleeves, such as **36**, of yieldable material such as plastic or rubber, and these, together with the yieldable characteristics of yoke **35**, insure that a card will be firmly grasped and driven between the rollers **24** and **32** while at the same time escaping mechanical damage from them. For these purposes, the inner ends of the yoke arms **35** are pivotally supported by spacer rod **10**, and the opposite ends are yieldably urged downwardly by a leaf spring **37** centrally bolted to spacer rod **11**. Yoke arms **35** in turn urge the thereinmounted shaft downwardly, along with its rollers **32**.

Data cards, such as card **18**, are guided into the bite between drive roller **24** and follower rollers **32** by a horizontal sheet-metal platen **38**, which preferably extends externally forward of the framework at the upper corner diagonally opposite that at which the motor is nested. Side guides **39** and **40**, spaced apart only slightly in excess of the card width, insure that the card must be aligned to fit properly between the side plates **6** and **7** and to enter the bite between the aforesaid rollers without any significant skew. Platen or insert tray **38** extends forwardly by an amount **41** which is enough less than the length **42** of a conventional card to permit the operator's fingers to maintain longitudinal end pressure on the card as it is being inserted in the direction of arrow **43**, and, thereby, to insure that the card will be grasped by and driven between the rollers **24** and **32**. Spacer rod **13** is horizontally disposed only slightly above the horizontal platen **38**, just sufficiently to admit card **18** below it and to insure that it will be horizontally oriented to feed between the rollers **24** and **32**.

Once the card is siezed by the rollers and is automatically powered into the space between side plates **6** and **7**, the properly oriented stripe **20** of magnetic material passes into cooperative electromagnetic association with the lower head end of transducer **19**. A proximate but non-scoring relationship between that transducer end and the stripe **20** is promoted by a combination of a yieldable downward urging and a limited universal-type jointing of the transducer head in its mounting on the framework. As is best shown in FIG. **3**, transducer head **19** is carried by a flat arm **44** having one end, **44*a***, hooked pivotally to spacer rod **10**, while the other end, **44*b***, is rested atop the forward spacer rod **11**; at both of these locations, the arm is free to rock laterally by limited amounts as determined by the accommodating slightly greater width of the reduced-diameter portions of these rods where the arm fits partly into these portions. A coil spring **45**, secured at one end to a frame-mounted pin **46** and at the other to arm end **44*a***, yieldably forces the transducer head downwardly. An advancing card will cause the thus-jointed yieldable head to level itself in relation to the magnetic stripe **20**, and irregularities or contaminants will not occasion such severe wear as would otherwise take place. Flexible electrical connections (not illustrated) are made with the terminals **47** of the transducer head. The lower magnetic head end of transducer **19** is preferably somewhat rounded, and is undercut laterally, at **19*a*** and

19*b*, so that the magnetic material of that end has a lateral span **48** which is less than that, **49**, of the magnetic stripe **20**, thereby improving efficiency and reducing susceptibility to edge variations in the stripe (FIG. **4**).

FIG. **2** aids in understanding that an advancing card, **18**, will at first be propelled horizontally by rollers **24** and **32** until its inner end engages a further frame-mounted sheet metal platen **50**, the forward end **50***a* of which is sloped to provide a ramp which will engage the advancing end of the somewhat stiff card and positively deflect it upwardly. That end of the card is thus maintained in a raised position when the opposite trailing end of the card leaves the rollers **24** and **32**. Under the latter conditions, the trailing end of the card must gravitate downwardly, in the direction of arrow **51**, and will in turn necessarily rest itself upon the periphery of roller **29** located below the aforesaid rollers. With belt **22** oriented as shown in FIG. **1**, roller **29** will rotate in a clockwise direction and act to propel card **18** in the reverse direction of arrow **52**, i.e., back toward the front. Further roller **28**, rotating clockwise also, likewise engages the dropped card, from the under side, and cooperates in propelling it to discharge onto the lower front sheet-metal discharge platen **53**. The latter extends forward of roller **29** by an amount less that that of the upper insertion platen **38**, such that the operator may readily grasp and remove the discharged card, shown in dashed-outline form **18***a* in FIGS. **1** and **2**. Both rollers **28** and **29** are preferably equipped with sleeves of material capable of making good frictional drive engagements with the card, such as soft plastic, fibrous material, or the like.

In those applications where it is desirable that the card discharge be from the rear of the framework, taut elastic belt **22** is simply reversed in its positions over roller ends **26** and **27**, as shown by dashed linework **30** and **31** in FIG. **1**, whereupon the rollers **28** and **29** will be continuously rotated counterclockwise by motor **21** and the dropped cards will be propelled rearwardly onto platen **50**, whence they will be discharged from the framework and may be retrieved by the operator. The transport of cards from manual insertion, through reading or encoding, and thence to discharge, occurs rapidly and without interruption.

The apparatus as it appears in FIG. **1** is lacking a housing or enclosure, which is normally in surrounding relation to all but the insertion and discharge sites and which has been omitted for clarity of illustration of key features.

It should be understood that a preferred embodiment of the invention has been described and depicted for purposes of disclosure, rather than limitation, and that those skilled in the art may introduce various modifications, combinations and substitutions without departure from the spirit and scope of this invention as set forth in the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. Magnetic data-card processing apparatus comprising a framework forming a passageway therein for the transport therethrough of a card carrying a stripe of magnetizable material, a substantially constant-speed continuously-running electric motor mounted in said framework, a pair of cooperating parallel rollers forming a bite to receive a card therebetween, means mounting one of said rollers in said framework for rotation in driven relation to said motor, means yieldably mounting the other of said rollers in said framework and resiliently urging said other roller toward peripheral engagement with said one roller, said yieldable mounting means comprising arm means pivoted in said framework and positioning said other roller therein toward engagement with said one of said rollers, and spring means yieldably urging said arm means in directions to force said roller toward said one of said rollers, a guide mounted in said framework for delivering a card into the bite between said rollers, electromagnetic read/encoder means including a transducer head, means mounting said transducer head and said other of said rollers side by side for magnetic interaction of said transducer head with a stripe of magnetizable material on a card at the site where the card is being driven by said rollers, said means mounting said transducer head including means resiliently urging said head toward engagement with the stripe of the card as it is being driven by said rollers at said site and further including means providing limited freedom for rocking movement of said head in directions transverse to direction of movement of the driven card, and means connecting said motor in driving relation to said one of said rollers.

2. Magnetic data-card processing apparatus comprising a framework forming a passageway therein for the transport therethrough of a card carrying a stripe of magnetizable material, a substantially constant-speed continuously running electric motor mounted in said framework, a pair of cooperating parallel rollers forming a bite to receive a card therebetween, means mounting one of said rollers in said framework for rotation in driven relation to said motor, means yieldably mounting the other of said rollers in said framework and resiliently urging said other roller toward peripheral engagement with said one roller, a guide mounted in said framework for delivering a card into the bite between said rollers, said guide comprising a substantially horizontal platen extending outwardly of said framework and spanning a distance from said bite of said rollers which is less than the length of a card, said guide and said rollers orienting a card substantially horizontally for transport through said rollers and past said transducer head, said guide further including substantially parallel and vertical sides spaced just slightly in excess of the width of a card, electromagnetic read/encoder means including a transducer head, means mounting said transducer head in said framework for magnetic interaction with a stripe of magnetizable material on a card at the site of said rollers as the card is being driven by said rollers, said means mounting said transducer head including means resiliently urging said head toward engagement with the stripe of a card as it is being driven by said rollers and further including means providing limited freedom for rocking movement of said head in directions transverse to direction of movement of a driven card, further roller means disposed in said framework for driving engagement with a card after it has left said rollers, substantially horizontal support means mounted in said framework in a position underlying that of a card which has passed through the rollers and disposed to engage a card at a position spaced from said rollers by a distance greater than half the length of a card, whereby a card discharged from the rollers will tend to tilt downwardly from said support means and into engagement with said further roller means, and belt means driven by said motor and

in driving relation to said one of said rollers and said further roller means.

3. Magnetic data-card processing apparatus as set forth in claim 2 wherein said support means comprises a platen having an end sloped upwardly in direction of movement of a card through said rollers and disposed to engage the forward end of a card passed through said rollers.

4. Magnetic data-card processing apparatus as set forth in claim 3 wherein said framework comprises a pair of substantially flat side plates, spacer means maintaining said side plates substantially parallel and vertical with a spacing therebetween just slightly in excess of the width of a card to form said passageway, said motor being disposed between said plates at a lower corner position and having a drive shaft extending through one of said plates, said one of said rollers having a driven shaft extending through said one of said plates, pulleys secured to said drive and driven shafts externally of said framework, additional horizontal roller means disposed in said framework between said further roller means and support means for driving engagement with a card after it has left said rollers, wherein said guide platen extends from said framework at an upper corner thereof diagonally opposite said lower corner, said further and additional roller means having driven shaft ends extending through said one of said side plates, said belt means comprising a taut elastic belt in engagement with said pulleys externally of said one of said side plates, said driven shaft ends of said one of said further and additional roller means being in driven engagement with said belt in the span of said belt between said pulleys, whereby said belt may be engaged with either side of each of said driven shaft ends to control directions of rotations of said further and additional roller means, and further comprising yieldable material in sleeved relation to said one of said rollers.

5. Magnetic data-card processing apparatus as set forth in claim 2 further comprising a second substantially horizontal platen below said guide platen, said second platen being disposed to receive a card discharged by said further roller means in direction opposite to said direction of movement.

6. Magnetic data-card processing apparatus as set forth in claim 5 wherein said second platen is disposed between said sides, wherein said second platen spans a horizontal distance from said further roller means which is less than the length of a card and extends outwardly of said framework a lesser distance than said guide platen, and wherein said belt means drives said driven roller and said further roller means in opposite angular directions, whereby a card is transported in said opposite direction for discharge from said framework.

7. Magnetic data-card processing apparatus as set forth in claim 6 further comprising additional horizontal roller means disposed in said framework between said further roller means and support means for driving engagement with a card after it has left said rollers, and wherein said belt means drives said further and additional roller means in the same angular direction.

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