United States Patent

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[54] **DOCUMENT TRANSPORTING**
8 Claims, 5 Drawing Figs.

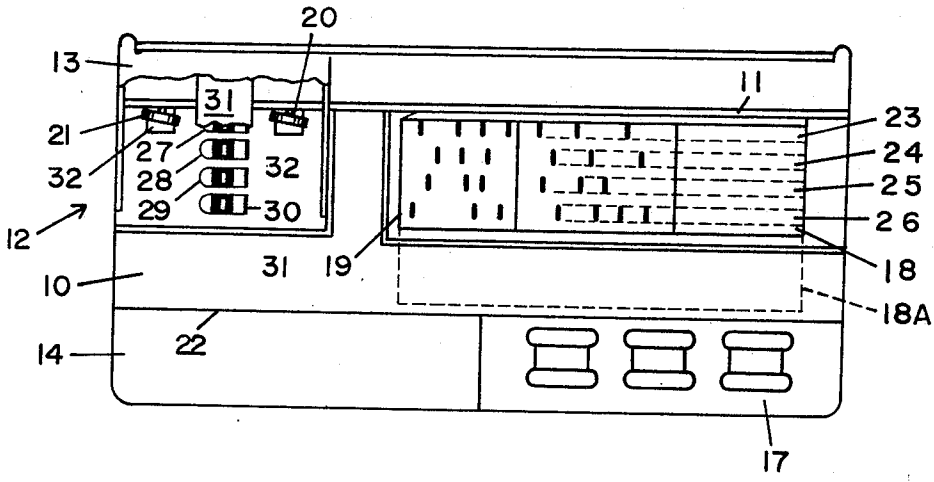
[52] **U.S. Cl.** **235/61.11,** 250/219
[51] **Int. Cl.** **G06k 13/07,** G06k 17/00
[50] **Field of Search** ..... 235/61.115, .115PM, 61.11, .111, .113; 250/219ID, IDC; 271/(Inquired)

[56] **References Cited**
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ABSTRACT: A cantilevered document-processing station is disposed over a document transport table. A document of any width is selectively transported under the cantilevered station for processing information with respect to the document. Canted drive rollers in the document-processing station move the document through the station and against a guide rail. A plurality of resilient document-holding fingers in the station have a dark color and a slit for improving the detecting resolution of the processing station in reading marks on the document.



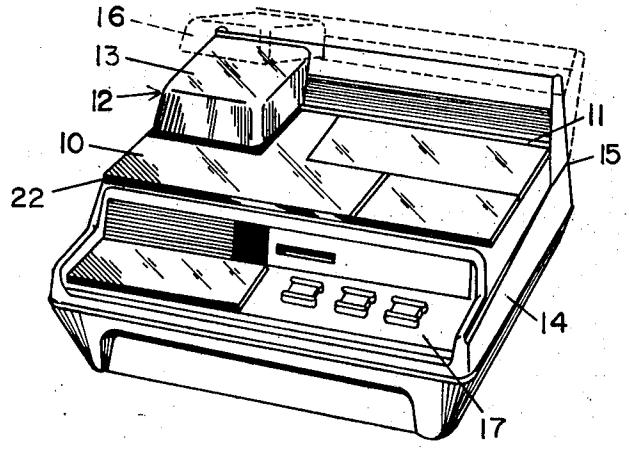


FIG 1

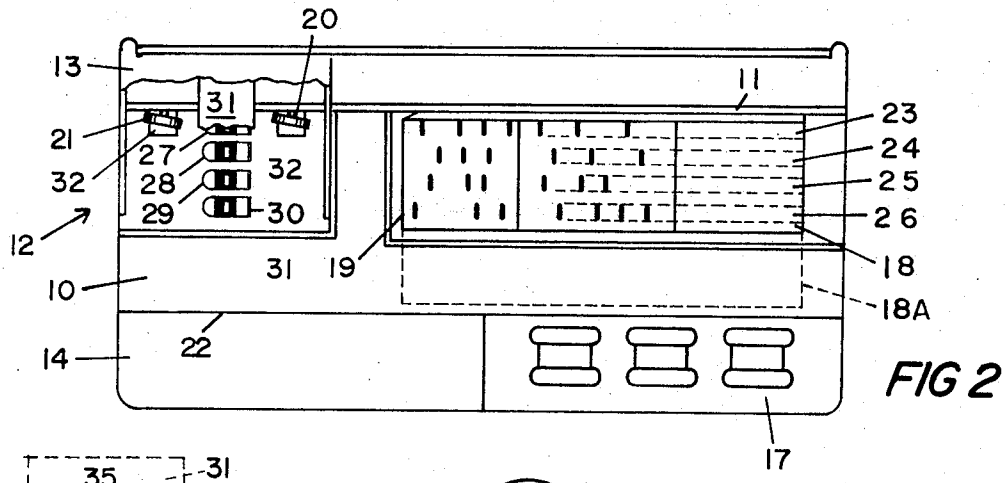


FIG 2

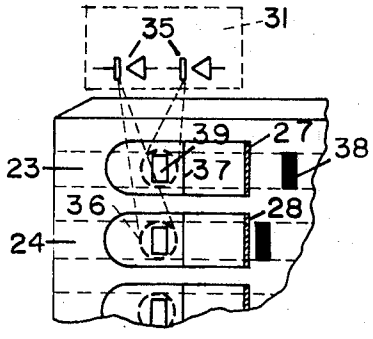


FIG 4

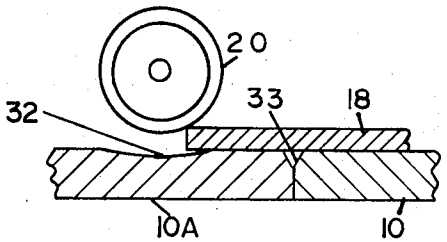


FIG 3

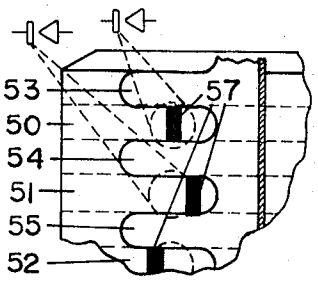


FIG 5

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DOCUMENT TRANSPORTING

BACKGROUND OF THE INVENTION

This invention relates to document-transporting machines and especially those machines for transporting documents with marks to be machine sensed, such as marks or holes on tabulating cards.

Many tabulating-card and other document-type processing machines are well known in the trade. Many of such machines require elaborate devices to guide the document being processed and to prevent the document from kinking or otherwise causing a malfunction, such as jamming, in the machine. Reliability of operation also has been a continuing problem.

Documents being processed in such machines include the well-known punched cards which have apertures or no apertures to indicate information, cards or documents with printed marks or no marks thereon corresponding to holes or no holes in a punched card, magnetic ink marks on a document, and other equivalent indicia.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a document-processing machine of low cost and high reliability.

It is another object of this invention to provide a document-processing machine capable of handling a document of an arbitrary width.

It is another object of the present invention to provide a document-processing machine with a single guide rail and of low cost construction.

A feature of the present invention is the provision of a cantilevered document-processing station disposed over a document transport table.

It is another feature that the document transport table be completely flat, with a guide rail only along one edge of the table and extending under the document-processing station.

It is another feature of this invention to include canted rollers designed to move the document along the document-processing station and against the guide rail.

It is another feature of this invention to have a plurality of resilient fingers in the document-processing station which press the document against the transport table. There is one finger disposed between each sensing element and over each column of marks to be sensed. The finger which is optically blackened approximately represents the field of view of the sensing element, etc. Such finger has an aperture of predetermined size for accenting the effect of a mark of the document on the sensing element.

Apparatus embodying the present invention includes a flat document transport table having a document guide rail extending the entire length of one edge of the table. The other edges have no guides. A document-processing station, such as a read station, is cantilevered adjacent the guide means to extend over a portion of the document transport table. The document to be processed is placed against the guide rail and then moved under the document-processing station. Upon engaging the drive rollers, the document automatically moves through the processing station. The guide rollers may be canted to ensure that the document is forced against the guide rail. Such canting is not greater than 3° for a page-type document and not greater than 5° for a tabulating card of usual weight.

In a reading or sensing operation, to increase the resolution of the marks on the document being sensed, the plurality of fingers beneath the document-processing head each has a blackened portion with an aperture therein. As the marks move under the finger, the contrast of the marks as seen through the aperture is greatly increased for improving the reliability of the document sensing.

When using a canted roller, the transport table may have a slight recess directly under the roller with the spacing between the bottom of the roller and the tabletop being less than the thickness of the document being processed. In this manner, good frictional engagement is provided between the document and the drive roller yet resiliency of the document limits the frictional grabbing such that the document is not forced over the guide rail.

THE DRAWING

FIG. 1 is a perspective view of an apparatus illustrating the present invention.

FIG. 2 is a diagrammatic plan view of the FIG. 1 apparatus with a cutaway portion showing the arrangement of the document-processing station.

FIG. 3 is a partial diagrammatic sectional view of the FIG. 2 apparatus showing the canted drive roller relationship to the document transport table.

FIG. 4 is a partial diagrammatic plan view of the relationship of an apertured resilient document-holding finger with respect to the sensing means for improving resolution of the sensing operation.

FIG. 5 is a diagrammatic illustration of a second arrangement of fingers for improving resolution.

DESCRIPTION OF THE ILLUSTRATIVE EMBODIMENT

Referring now to the drawing, like numbers indicate like parts and structural features in the various views. A card page reader or sensing device is utilized to illustrate the present invention. The reader has a document transporting table **10** with a flat upper surface. A single document guide rail **11** is disposed along one edge of the table and extends under and through document-processing station **12**. Document-processing station **12** may include an optical sensing unit of known design. Station **12** is cantilevered over table **10** from behind and adjacent guide rail **11**, as best seen in FIG. **1**. Housing **13**, covering station **12**, is pivoted on the reader case **14** as at **15** for rotation to the dotted line position **16** to expose the operating equipment in the processing station and operator adjustment controls (not shown) for other portions of the card reader. A reader-control console **17** is integrally formed with housing **14** and includes a plurality of control switches for performing actuating functions such as rotation of drive rollers, actuating the processing station, and the like. Such functions may be automatic in that signals from a computer (not shown), and the like, may be used to actuate such performance.

In utilizing the FIG. **1** illustrated reader, a document, such as tabulating card **18**, is placed on table **10** and against guide rail **11**. Card **18** is then moved in a first direction such that leading edge **19** is within document-processing station **12**. Card **18** then engages first drive roller **20** (FIG. **2**). Rotating drive roller **20** then moves document **18** through the processing station **12**. Tandem drive roller **21** rotates at the same speed as roller **20** and ensures that document **18** smoothly passes through station **12**. Card **18** may be any width and still be transported through processing station **12**. For example, dotted line **18A** indicates an arbitrarily wider document which is usable with the present invention. In such wider documents, only those marks passing through station **12** will be machine read; the remainder of the document may be used for recording visually read data. When a sufficiently rigid document is provided, the document edge away from guide **11** may extend over the edge **22** of table **10** and still be successfully transported by the illustrated apparatus.

Referring more particularly now to FIG. **2**, rollers **20** and **21** are shown as being canted, that is, they are disposed at an angle with respect to the direction of travel of card **18**. This angle is greatly exaggerated in the FIG. **2** drawing to illustrate the principles involved. When using a page type of document such as heavy bond paper, it is believed that the canted angle of rollers **20** should not be greater than 3°, while with tabulating card **18** it is believed that the angle should not be greater than 5°. While documents of different weights are transportable by rollers disposed at a given angle, generally the heavier the document, the greater the permissible canted angle.

Such canted rollers practically eliminate the need for regulating the width of the document being processed. The drive for the document is essentially along the one edge adjacent card guide **11** with the outer edge of the document being completely independent of the drive mechanism. For documents such as tabulating cards, the rollers may be spaced about one-half inch from guide rail **11**. For narrower documents, such as teleprinter tape, the rollers must be closer to rail **11** to prevent skewing the document. Documents wider than tabulating cards are transportable with the ½- inch spacing.

The canted drive rollers **20** and **21** move the document **18** to the left, as viewed in FIG. **2**, and against guide **11**. If the canting of rollers **20** and **21** is too great, the document **18** has a tendency to move over the guide. While rollers **20**, **21** may be disposed such as to be parallel to the direction of travel of document **18**, the canting will ensure alignment of the data rows **23** through **26**, for example, on document **18**, with the read stations immediately above fingers **27**, **28**, **29**, and **30** in the document-processing station **12**. Fingers **27** through **30** are formed of resilient material and press against document **18** to hold it firmly against table **10** to ensure a constant distance between the document and the sensing elements in the read-out head assembly **31**. Head assembly **31** may be constructed in any manner and may utilize photodiodes (and the like) with **9** light source in the assembly (not shown) which shines light onto document **18**. The reflected light is then sensed by the photodiodes for indicating the presence or absence of data marks on the card **18**.

When using canted rollers **20** and **21**, slight depressions **32** should be provided in table **10**. As best seen in FIG. **3**, canted drive roller **20** is disposed directly above depression **32**. Depression **32** is formed to match that of the drive wheel such that when document **18** is passed under drive wheel **20** it is slightly bent into depression **32** to control the frictional engagement between document **18** and drive roller **20**. Without depression **32**, the drive roller **20** could force document **18** over guide means **11**. Depression **32** is longer than the thickness of roller **20** for permitting flexure of card **18** but does not extend across table **10** for preventing card **18** buckling in the depression.

Table **10** may be formed of a plurality of parts. For example, the portion immediately below document-processing station **12** may be separate from the portion outside of such station. This portion of table **10** is indicated in FIG. **3** as insert **10A**. The junction between table **10** and insert **10A** is beveled as at **33** such that no corners extend above the upper surface for card **18** to catch upon.

Referring next to FIG. **4**, the principles involved in improved sensing of data marks on document **18** are illustrated. Fingers **27**, **28** are shown directly above data rows **23**, **24**. Photodiodes **35** are schematically shown as receiving light from a field of vision indicated by dotted circles **36** above the fingers. Finger **27** has low reflective portion **37** such that the reflected light from finger **27** to one of photodiodes **35** is minimized. When no data mark **38** is present under **27**, aperture **39** permits a predetermined amount of light reflected from document **18** to reach the one diode **35**. When mark **38** moves under aperture **39**, the reflected light is greatly decreased to provide improved reliability by increasing resolution in sensing the presence or absence of a data mark.

Referring next to FIG. **5**, there is shown in diagrammatic form an alternate technique for improving resolution of the sensing operation. Three mark-sense channels **50**, **51**, and **52** are disposed intermediate three spaced-apart and optically blackened fingers **53**, **54**, and **55**. The plurality of marks **57** to be sensed are intermediate the three fingers. The fields of vision of the sensing photodiodes are indicated by the dotted circles. The improvement in resolution is somewhat less than that afforded by the configuration shown in FIG. **4**. This latter arrangement is suitable when the photodiodes have a more limited field of sensing than those photodiodes used with the FIG. **4** arrangement.

I claim:

1. A document processing machine comprising:
a document supporting table having an upper flat surface;
a guide rail extending along one edge of said table for guiding documents being transported upon the surface of said table;
document-processing means disposed over the document table and supported from said one edge of said table over said guide rail and extending only partially over said document table, said document-processing means including resilient finger means extending downwardly therefrom to engage the upper surface of said table, said resilient finger means engaging said upper surface to permit the document being processed to slide therebetween whereby said document is urged against said upper surface;
said resilient finger means including at least one resilient finger having a low light reflective portion, said portion containing an aperture through which data marks on documents are optically sensed;
sensing means contained in said document-processing means for sensing data marks through the apertured finger on documents being processed; and
drive means adjacent said document-processing means for frictionally driving documents on the surface of said table, said drive means being affixed to said table proximate to the document-processing means, said drive means including drive rollers only adjacent said guide rail.

2. The invention of claim **1** wherein: said drive rollers rotate at a small angle with respect to said guide rail.

3. The invention of claim **2** wherein said angle is not greater than 5°.

4. The invention of claim **2** wherein said angle is not greater than 3°.

5. The invention of claim **3** wherein said drive rollers are about one-half inch from said guide rail.

6. The invention of claim **1** wherein said document-processing means includes a plurality of sensing means each having a predetermined field of sensing, said document-processing means including: a plurality of optically blackened resilient fingers extending downward to said table for holding a document thereagainst and each finger disposed between adjacent ones of said sensing means for limiting reflected light with the respective fields of sensing.

7. A document transport means comprising in combination:
a document table having an upper flat surface;
a guide rail extending substantially the entire length along one edge of said document table;
friction rollers rotatably disposed over said document table for rotation to move documents in a first direction parallel to said guide rail and having a spacing from the table slightly less than the thickness of any document to be processed, said table having a slight recess immediately under each of said rollers with the spacing between the top of the document table and the bottom of the roller being substantially less than the document thickness, with each recess being only slightly longer than the thickness of said rollers; and
said rollers being disposed at a small angle with respect to the direction of travel of any document such that when the rollers rotate any document is forced against said guide rail as well as along said first direction.

8. The invention of claim **7** further including document-processing means mounted adjacent said guide rail means and cantilevered over said tabletop such that a document of any width may be moved thereunder in said first direction without physical obstruction.