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(54) **Apparatus for registering sheets.**

(57) Apparatus for registering sheets in a corner (32) includes a pair of adjacent paddle wheels (71, 72) that are angled differently. Each paddle wheel is angled at approximately 10° to 25° from its adjacent registration wall (37, 38) to drive the sheet into registration with the other wall for corner registration. The paddle wheels (71, 72) are synchronized so that only one blade (80) on one wheel contacts the sheet at a time. Acting on the sheet alternately allows the paddle wheels quickly to corner register the sheet.

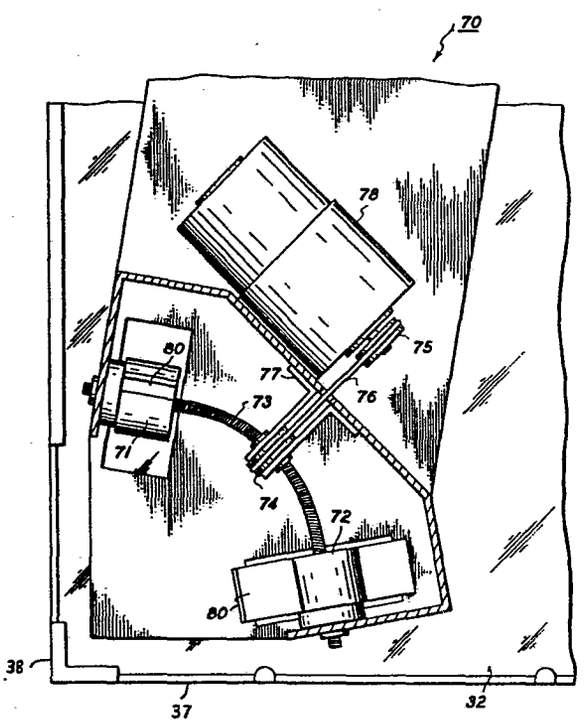

FIG. 2

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Apparatus for registering sheets

This invention relates to apparatus for registering sheets in a corner defined by intersecting registration walls that form a 90^{o} angle including a pair of paddle wheels located in position to drive sheets into said corner.

Modern advancement in high speed copying machines lead to early recognition that machine operators could not perform their normal functions at a speed commensurate with the speed of the copying machine, resulting in copy output from the machines much lower than the printing speed of the machine. To minimize operator involvement and allow maximum output from the printing machine, automatic features were needed.

It is in answer to this need that the automatic corner registration system of the present invention is provided. Registration systems in the past have employed rollers to align first a front edge and subsequently the rear edge of a document as disclosed in U.S. Patent 3,980,296, issued September 14, 1976, to James Alexander Craft et al. Another registration system is shown in U.S. Patent 4,029,309, issued June 14, 1977, to Thomas Lynch et al. This registration system discloses the use of two orthogonal, out-of-phase, synchronized single paddle wheels for corner registration.

Apparatus according to the present invention is characterised in that paddle wheels are arranged at an angle of less than 90^{o} to an adjacent registration wall, whereby documents alternately acted upon by said dual paddle wheels are promptly worked into registration with said corner. The wheels are preferably angled 10^{o} to 25^{o} respectively from their adjacent registration wall and have two paddles on each wheel. The angles allow for smooth acquisition by the paddles and virtually eliminate paper jams, stalls and damage due to a perpendicular approach of paddles. Also, the speed paddle is faster than the incoming sheet speed which helps to prevent paper wrinkle and jams.

An embodiment of the invention will now be described with reference to the accompanying drawings, in which:-

Figure 1 is a schematic elevational view of an electrophotographic printing machine incorporating registration apparatus according to the present invention therein, and

Figure 2 is a plan view of the registration apparatus of Figure 1.

Figure 1 schematically depicts the various components of an illustrative electrophotographic printing machine incorporating a document corner registration apparatus according to the present invention therein. It will become evident from the following discussion that the registration system is equally well suited for use in a wide variety of devices and is not necessarily limited to its application to the particular embodiment shown herein. For example, the apparatus of the present invention may be adapted for use in compilers or readily employed in non-xerographic environments and sheet registration in general.

As shown in Figure 1, the electrophotographic printing machine employs a belt 10 having a photoconductive surface 12 deposited on a conductive substrate 14. Preferably, photoconductive surface 12 is made from a selenium alloy with conductive substrate 14 being made from nickel. Belt 10 moves in the direction of arrow 16 to advance successive portions of photoconductive surface 12 sequentially through the various processing stations disposed about the path of movement thereof. Belt 10 is entrained around stripper roller 18, tension roller 20, and drive roller 22.

Drive roller 22 is mounted rotatably in engagement with belt 10. Motor 24 rotates roller 22 to advance belt 10 in the direction of arrow 16. Roller 22 is coupled to motor 24 with a suitable means such as a belt drive. Drive roller 22 includes a pair of opposed spaced flanges or edge guides 26. Edge guides 26 are mounted on opposite ends of drive roller 22 defining its space therebetween which determines the desired predetermined path of movement for belt 10. Edge guide 26 extends in an upwardly direction from the surface of roller 22. Preferably edge guides 26 are circular members or

flanges.

Belt 10 is maintained in tension by a pair of springs (not shown), resiliently urging tension roller 20 against belt 10 with the desired spring force. Both stripping roller 18 and tension roller 20 are mounted rotatably. These rollers are idlers which rotate freely as belt 10 moves in the direction of arrow 16.

With continued reference to Figure 1, initially a portion of belt 10 passes through charging station A. At charging station A, a corona generating device, indicated generally by the reference numeral 28, charges photoconductor surface 12 of the belt 10 to a relatively high, substantially uniform potential. A suitable corona generating device is described in U.S. Patent No. 2,836,725, issued to Vyverberg in 1958.

Next, the charged portion of photoconductive surface 12 is advanced through exposure station B. At exposure station B, an original document 30 is positioned face down upon transparent platen 32. Lamps 24 flash light rays onto original document 30. The light rays reflected from the original document 30 are transmitted through lens 36 from a light image thereof. The light image is projected onto the charged portion of the photoconductive surface 12 to selectively dissipate the charge thereon. This records an electrostatic latent image on photoconductive surface 12 which corresponds to the informational areas contained within original document 30.

Thereafter, belt 10 advances the electrostatic latent image recorded on photoconductive surface 12 to development station C. At development station C, a magnetic brush developer roller 38 advances a developer mix into contact with the electrostatic latent image. The latent image attracts the toner particles from the carrier granules forming a toner powder image on photoconductive surface 12 of belt 10.

Belt 10 then advances the toner powder image to transfer station D. At transfer station D, a sheet of support material 46 is moved into contact with the toner powder image. The sheet of support material is advanced to transfer station D by a sheet feeding apparatus 42. Preferably, sheet feeding apparatus 42 includes a feed roll 44 contacting the upper sheet 46 of the stack. Feed roll 44 rotates so as to advance the uppermost sheet from the stack into transport 91. The transport directs the advancing sheet of support material into contact with the photoconductive surface 12 of belt

10 in a timed sequence so that the toner powder image developed thereon contacts the advancing sheet of support material at transfer station D.

Transfer station D includes a corona generating device 50 which emits ions onto the backside of sheet 46. This attracts the toner powder image from the photoconductive surface 12 to sheet 46. After transfer, the sheet continues to move in the direction of arrow 52 onto a conveyor (not shown) which advances the sheet to fusing station E.

Fusing station E includes a fuser assembly, indicated generally by the reference number 54, which permanently affixes the transferred toner powder image to sheet 46. Preferably, fuser assembly 54 includes a heated fuser roller 56 and a backup roller 58. Sheet 46 passes between fuser roller 56 and backup roller 58 with the toner powder image contacting fuser roller 56. In this manner, the toner powder image is permanently affixed to sheet 46. After fusing, shoot 60 guides the advancing sheet 46 to catch tray 62 for removal from the printing machine by the operator.

Invariably, after the sheet of support material is separated from the photoconductive surface 12 of belt 10, some residual particles remain adhering thereto. These residual particles are removed from photoconductive surface 12 at cleaning station F. Cleaning station F includes a rotatably mounted fiberous brush 64 in contact with the photoconductive surface 12. The particles are cleaned from photoconductive surface 12 by the rotation of brush 64 in contact therewith. Subsequent to cleaning, a discharge lamp (not shown) floods photoconductive surface 12 with light to dissipate any residual electrostatic charge remaining thereon prior to the charging thereof for the next successive image cycle.

Referring now to the specific subject of the present invention, Figure 1 shows a document corner registration system 70 that employs paddle wheels with more than one blade mounted on either side of a corner and formed at an angle of less than 90° by a bent flexible shaft. This device enables effective registration of a wide range of sheet input positions and orientations by supplying two driving forces at large angles to each other.

More specifically, as shown in Figure 2, in order to achieve registration of documents with a wide range of skew angles and a side edge location when entering document handler 70, a two paddle wheel system is provided.

The planar blades or paddles 80 are made of urethane, silicone or other flexible, frictional material and are maintained 90° out of phase with each other. Therefore, only one blade contacts the document through the drive sweep uninhibited by the second wheel. As an alternative use, by adjusting the height of the wheels when registering a stack of substrates or sheets with the present invention, at least one blade can be made to contact the stack at all times thereby providing continuous control to reduce bounce off the side wall or retaining fingers of the tray holding the stack. Preferably, the document contacts the upstream blade first to reduce registration time. However, registration will be completed for any document that comes under control of either paddle wheel.

In operation, documents 30 that are placed onto platen 32 are met by dual adjacent paddle wheels 71 and 72 that are angled differently. Each paddle wheel is mounted on curved flexible shaft 73 and angled at approximately 10° to 25° from its adjacent registration wall 37,38 to drive the document into registration with the other 90° wall, for corner registration. Also, the two wheels are synchronized so that only one blade on each wheel contacts the document at a time. The document is quickly worked into the corner registration position by each paddle wheel alternately acting on the document predominately on one axis. Rotation of paddle wheels 71 and 72 is obtained by actuation of drive motor 78 by any suitable means, such as, a switch triggered by the document. The motor 78 in turn drives pulley 75 which is drivingly connected to pulley 74 through belt 76. The driving of pulley 74 turns cable or shaft 73 on which is mounted paddle wheels 71 and 72.

In conclusion, an improved corner registration system is disclosed that includes two adjacent but differently angled registration paddle wheels. Each of the paddle wheels are at angles of less than 90° in relation to its adjacent side wall, however, the paddle wheels are preferably angled at approximately 10° to 25° from its adjacent registration wall. Also, the two wheels are synchronized so that only one blade on one wheel contacts the document at one time. In this way, the document is positively worked into corner registration with haste.

Claims:

1. Apparatus for registering sheets in a corner (32) defined by intersecting registration walls that form a 90^{o} angle, including a pair of paddle wheels (71, 72) located in position to drive sheets into said corner, characterised in that said paddle wheels are arranged at an angle of less than 90^{o} to an adjacent registration wall (37, 38), whereby documents alternately acted upon by said dual paddle wheels are promptly worked into registration with said corner.

2. Apparatus according to claim 1, wherein each paddle wheel (71, 72) is angled approximately 10^{o} to 25^{o} from its adjacent registration wall (37, 38).

3. Apparatus according to claim 1 or 2, wherein said two paddle wheels (71, 72) enable effective registration of a wide range of sheet input positions and oreintations by supplying two driving forces at large angles to each other.

4. Apparatus according to claim 1, 2 or 3, wherein sheets are forwarded into said corner (32) by each paddle wheel (71, 72) alternately acting upon the documents predominately on one axis.

5. Apparatus according to claim 1, 2, 3 or 4, wherein said paddle wheels (71, 72) are mounted on a common flexible shaft (73).

6. Apparatus according to any preceding claim, wherein each of said paddle wheels (71, 72) has at least two blades (80).

7. Apparatus according to claim 4, wherein said paddle wheels (71, 72) are synchronised so that only one blade (80) on each wheel contacts a sheet at a time.

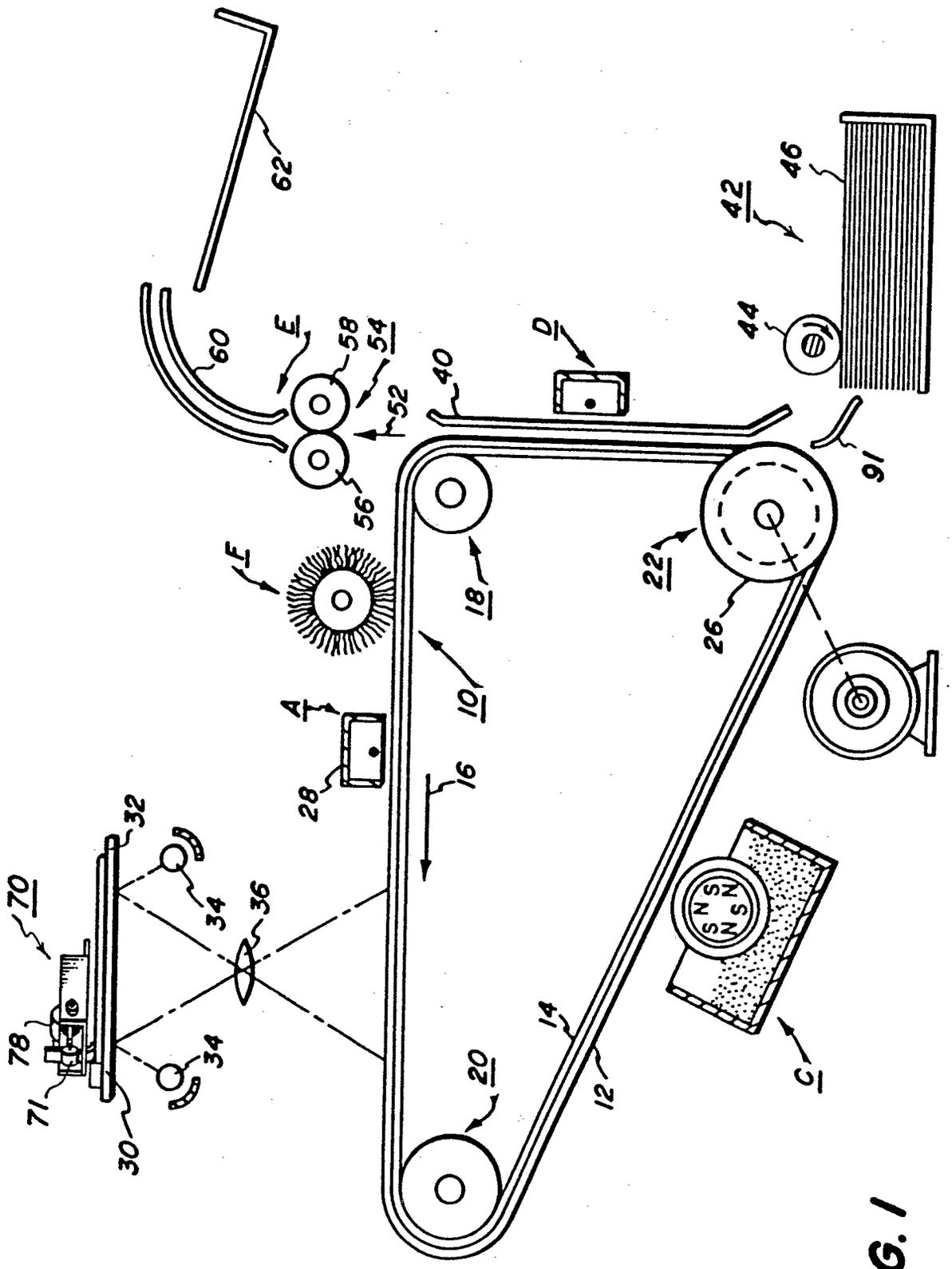
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FIG. 1

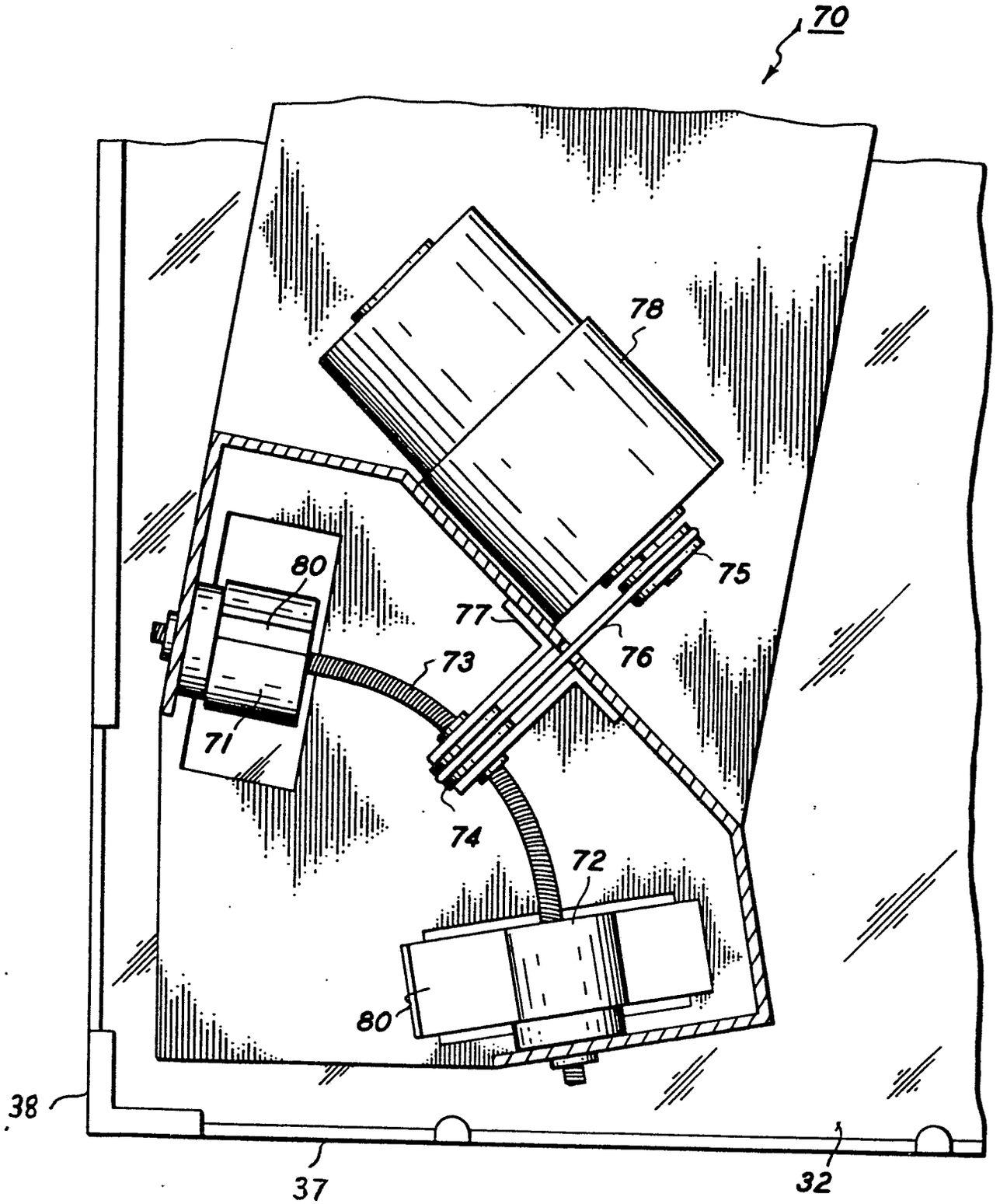

FIG. 2

European Patent Office

EUROPEAN SEARCH REPORT

Application number
EP 81303553.2

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
D	GB - A - 1 492 168 (IBM) * Fig. 2 * & US-A-3 980 296	1,2,3,4
	GB - A - 1 496 079 (XEROX) * Page 11, lines 101-130; page 12, lines 1-15; claims; fig. 18A *	1,2,5
X	US - A - 4 179 117 (RHODES) * Fig. 8; column 4, lines 16-25 *	1,2,3,5
X	GB - A - 1 427 357 (XEROX) * Fig. 1; page 6, lines 16-62, 63-79 *	1,2,3,4,6,7
	US - A - 3 630 516 (BYUNG HONG) * Fig. 1-6 *	1,6
D	US - A - 4 029 309 (LYNCH) * Fig. 1 *	1,2,3,4,7

CLASSIFICATION OF THE APPLICATION (Int. Cl.³)

G 03 G 15/00
B 65 H 9/00

TECHNICAL FIELDS SEARCHED (Int. Cl.³)

G 03 G 15/00
G 03 B 27/00
B 42 B 2/00
B 65 H 3/00
B 65 H 5/00
B 65 H 9/00

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A. technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L. citation for other reasons

&. member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	09-11-1981	KRAL