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(54) Cost efficient printer.

(57) A quiet, cost efficient printer having powered ink (3) in a reservoir (1). Endless belt (9) is resistive for resistive ribbon printing at the nip between resistive-ribbon printhead (7) and drum (5). The drum is magnetic, and ink on the drum adheres to belt 9 in the pattern determined by the printhead. The image is 10 transferred to paper (19) by heat at pressure at two transfer rollers (15 and 17). This operation is repeated continuously, and belt 9 is not normally replaced.

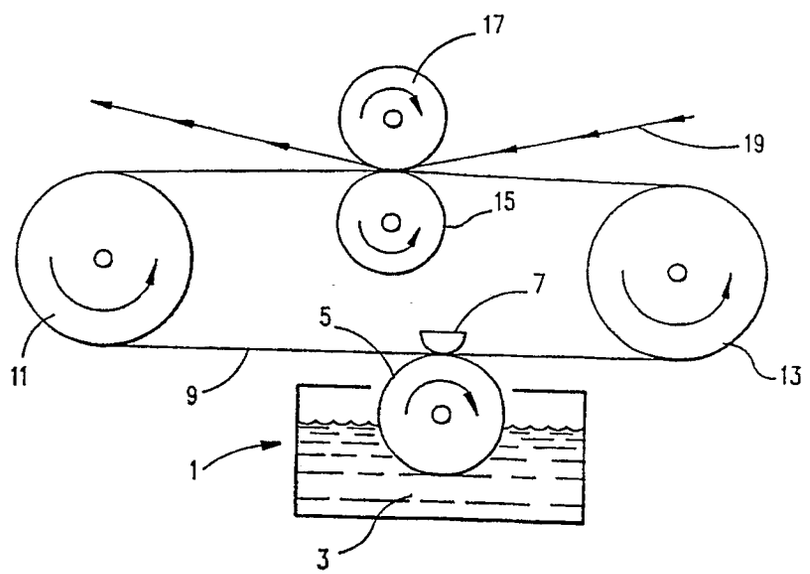

FIG. 1

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COST EFFICIENT PRINTER

Technical Field

This invention relates to printers employing thermal imaging, thermal transfer of the images formed, and renewal of the thermal ink from a reservoir of powdered ink. The invention is particularly suited to page printers, and employs an endless transfer belt, transfer of powdered ink to the belt, and a thermal printhead to form images on the belt, from which the images subsequently are transferred by heat and pressure.

Background of the Invention

Resistive ribbon printing employing an endless ribbon is generally known, as described in IBM Technical Disclosure Bulletin article entitled "Multi-Use Resistive Ribbon," Vol. 28, No. 1, June 1985 at pp. 257-258. The ink is replenished, but in no such system known is the ink replenished by transfer of a 20 powdered ink.

Transfer of powered ink is known, but not to a thermal printing station. The preferred embodiment of this invention would employ both the magnetic electrophotographic ink and the transfer drum of a 25 standard electrophotographic printing system. Similar ly, printing by powered ink transferred to the printing station is disclosed in IBM Technical Disclosure Bulletin article entitled "Magnetically Addressable Matrix Printing and Fusing," Vol. 13, No. 5, Nov. 1970 at p. 1643. In this disclosure the imaging is also by magnetic action, and the printing elements are hot, thereby fusing the ink in the image formed.

Transferring of a formed image by heat and pressure is generally known, as illustrated in U.S. Patent No. 4,692,395 to Findlay.

Such known printers, however, do not combine both simplic ity and low cost to achieve a cost efficient printer as does this invention.

Disclosure of the Invention

In accordance with this invention, a quiet, low-cost printer, preferably a page printer, is achieved by employing a powered ink continually brought to an endless thermal ribbon substrate. A thermal printhead contacting the substrate causes melting of the ink in image form on to the substrate. The side of the substrate is subsequently contacted with paper between heated rollers, where the image transfers to the paper to complete the printing. The cycle is completed by continuous movement of the endless 20 substrate.

In the preferred embodiment, the ink is a magnetic powder which may be identical to that used in standard electrophotographic page printers having magnetic toners. Similarly, in the preferred embodiment, the ink is transferred by magnetic drum which may be identical to that used in such standard electrophotographic page printers.

Brief Description of the Drawing

The drawing shows illustratively the preferred printer of this invention.

Best Mode for carrying out the Invention

This printer comprises a reservoir or container containing powered ink 3 and a transfer drum 5, all extending in length at least the width of a page to be printed. Ink 3 and drum 5 in this preferred embodiment are essentially identical with standard 10 electrophotographic toners and toner transfer drums having magnetic systems, particularly that of the Hewlett-Packard LaserJet printers.

Thermal printhead 7 is positioned above drum 5 and in light contact with endless resistive belt 9. 15 Printhead 7 contains a line of closely spaced electrodes extending in length (into the page as shown in the drawing) at least the width of a page to be printed. As is standard for resistive ribbon printing, the electrodes of printhead 7 produce current in 20 patterns of the images to be formed, with the current passing through belt 9, which is resistive, to thereby produce heat in the patterns of those images.

The resistive ribbon substrate as described in the foregoing article entitled "Multi-Use Resistive Ribbon" 25 is that of the preferred embodiment. That has a polyimide resistive layer, a very thin aluminum layer, and a very thin outer layer of nickel. The aluminum layer provides a replenishing site of aluminum oxide near the printing, which beneficially moves much of the 30 heating near the printing. The nickel layer is for mechanical strength. In this embodiment drum 5 carrying toner 3 contacts the nickel side of belt 9. Heat produced in belt 9 from current injected by printhead 7 melts ink 5, which then adheres to belt 9 in that pattern.

Rollers 11 and 13, one of which is driven, as by a motor (not shown), are positioned on opposite sides of printhead 7 to continuously guide belt 9 at a predetermined speed in a repeating, closed path. Complete images are formed at printhead 7 on the moving 10 belt 9. These subsequently are positioned between a roller 15, which is heated, and a roller 17, which is a back-up roller providing pressure. Ordinary paper 19, to receive the final image,

is positioned between the belt 9 and the roller 17.

In operation, drum 5 moves during printing to continually contact the ink 3 in reservoir 1 and holds the ink 3 by magnetic attraction while moving the ink to belt 9, where some ink 3 is melted in the image pattern onto belt 9. The ink 3 melted in a pattern continues to move with belt 9, while the remaining ink 3 continues to move with drum 5. Rollers 15 and 17 form a transfer station, the heat of roller 15 and pressure from the two rollers 15 and 17 causing the ink to flow, where it is then held by paper 19.

This printer achieves cost effectiveness by employing simple and effective features of both thermal printing and electrophotography. Belt 9 is not normally replaced, giving added cost savings. Many standard refinements may be added to this system, such 30 as a belt-cleaning station subsequent to the transfer rollers 15 and 17. The powdered ink 3 may be electrostatic, and the transfer element or drum 5 similarly electrical rather than magnetic. Other improvements and variations would be within the spirit and scope of this invention.

Claims

1. A printer comprising a container of powered ink, an endless belt for thermal imaging, transfer means to move said ink from said container to an area of contact with said belt, a thermal printhead at said area of contact to heat said belt in image patterns to melt said ink in said patterns which adhere to said belt, and a transfer station to contact a print receiving medium with said ink patterns and to heat said ink patterns to transfer said ink patterns to said print 10 receiving medium.

2. The printer as in claim 1 in which said endless belt is resistive for printing by electric current heating said resistive belt and said printhead is a resistive ribbon printhead.

3. The printer as in claim 1 or 2 in which said ink is magnetic and said transfer means is a magnetic drum.

4. A printer comprising a reservoir of magnetic ink, an endless belt for thermal imaging, transfer means to contact said ink in said reservoir and hold said ink by magnetic attraction while moving said ink from said container to an area of contact with said belt, a thermal printhead at said area of contact to heat said belt in image patterns to melt said ink in said patterns which adhere to said belt, and a transfer station to contact a printing receiving medium with 10 said ink patterns and to heat said ink patterns to transfer said ink patterns to said print receiving medium.

5. The printer as in claim 4 in which said endless belt is resistive for printing by electric current heating said resistive belt and said printhead is a resistive ribbon printhead.

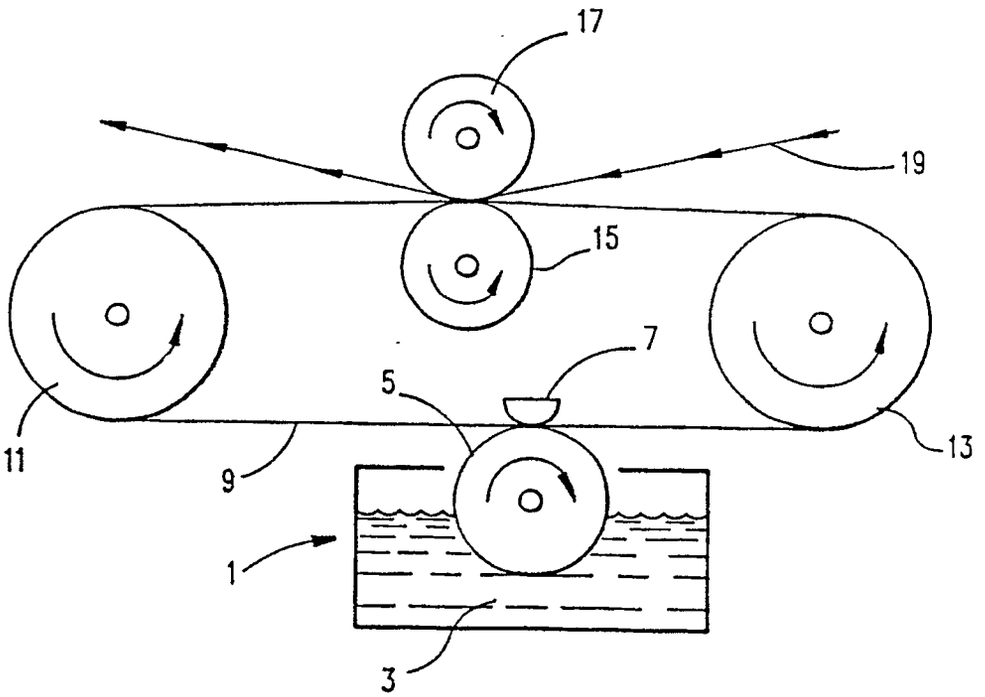

FIG. 1

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 90 48 0197

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	PATENT ABSTRACTS OF JAPAN vol. 6, no. 161 (M-151)(1039) 24 August 1982, & JP-A-57 75898 (SHINKO DENKI K.K.) 12 May 1982, * the whole document *	1-5	B 41 M 5/38
A	PATENT ABSTRACTS OF JAPAN vol. 10, no. 234 (M-507)(2290) 14 August 1986, & JP-A-61 66695 (CANON INCORPORATED) 05 April 1986, * the whole document *	1-5	
A	PATENT ABSTRACTS OF JAPAN vol. 9, no. 206 (M-406)(1929) 23 August 1985, & JP-A-60 67195 (SAKATA SHIYOUKAI K.K.) 17 April 1985, * the whole document *	1-5	
A	PATENT ABSTRACTS OF JAPAN vol. 9, no. 114 (M-380)(1837) 18 May 1985, & JP-A-60 992 (CANON K.K.) 07 January 1985, * the whole document *	1-5	
A	PATENT ABSTRACTS OF JAPAN vol. 8, no. 57 (M-283)(1494) 15 March 1984, & JP-A-58 208073 (YOKOGAWA DENKI SEISAKUSHO K.K.) 03 December 1983, * the whole document *	1-5	TECHNICAL FIELDS SEARCHED (Int. Cl.5): B 41 M

The present search report has been drawn up for all claims

Place of search	Date of completion of search	Examiner
The Hague	09 April 91	BACON,A.J.

CATEGORY OF CITED DOCUMENTS

X: particularly relevant if taken alone
Y: particularly relevant if combined with another document of the same catagory
A: technological background
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P: intermediate document
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E: earlier patent document, but published on, or after the filing date
D: document cited in the application
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