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# (54) System and method for drying ink on a printing medium

System und Verfahren zum Trocknen der Druckfarbe auf einem Druckmedium

Système et procédé de séchage de l'encre déposée sur un support d'impression

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- **XEROX DISCLOSURE JOURNAL, vol.7, no.6, November 1982 GILBERT M. ELCHINGER 'ELECTROSTATIC DRYER FOR INK JET PRINTERS'**



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## Description

This invention relates generally to the concept of drying ink applied to a printing medium by a printer during its printing operation, and more particularly to the drying of the ink without using the use of dedicated heaters for that purpose.

Prior art printer dry ink imprinted into a printing medium, usually paper, through the use of heaters. These heaters do nothing else but dry the ink.

Typical conventional methods of removing heat from a printer employ the use of dedicated heat sinks. For example, U.S. 4,982,207 to Tunmore et al. refers to a platen heater system for providing heat to a print sheet during its dwell time on the platen. The platen system comprises a heat foil for heat transfer between a power source and platen through a platen shell.

U.S. 5,046,420 to Sondergeld et al. describes a printer for tempering the operating temperature of printer elements by means including diversion of hot air generated by a printer to the elements to be tempered. It is stated that the printer avoids the potential need to heat application from an external source (col. 2, lines 19-26).

U.S. 3,074,332 to Robinson refers to a drying platen adapted for heat transfer relationships with a record. The platen is heated by "insert heaters".

U.S. 3,170,393 to Reinke describes a heat settable ink curable by brief engagement with a heated surface after imprinting.

U.S. 3,934,112 to Lakhani discloses a heater platen with electric heater elements for volatilizing a liquid toner carrier after imaging.

U.S. 4, 751, 528, U.S. 4, 951, 067 and U.S. 5,043,741, all to Spehrley, Jr., refer to heat-controlled platens for use in conjunction with hot melt ink.

In US-A- 5, 136,329 there is disclosed a printer comprising a thermally conductive platen and a heat generating module in contact with the platen. Heat generated in the heat generating module is conductively transferred to the platen, thereby heating the platen. Printed media contact with and travel across the platen and are provided with heat which causes ink on the printed media to dry.

This invention is directed to a system and method for drying ink on a printing medium during the printing process, and to a printer which employs such system and method. Instead of removing heat from a printer using a dedicated heat sink, as is done in some prior art systems, the subject system has created a non-dedicated heat sink therewith in by conducting heat from a printer power supply to a thermally conductive platen for drying ink imprinted on paper in contact with the thermally conductive platen and thereby dissipating the heat from within the system.

For liquid-based printing processes, e.g., ink jet printing, the heated platen aids the ink drying process, allowing for faster printing throughput and improved print quality. The introduction into the subject system of conventional dedicated heat sinks is not required again avoiding additional costs and additional space within the printer. This also allows for increased product density due to the space availability. Paper moving over the thermally conductive platen automatically helps to remove heat build up within the printer whenever it is used. The heat removal rate is automatically matched to the rate of heat generation in the system.

In accordance with the present invention there is provided a method for drying ink deposited onto a printing medium and a printer for carrying out the method as specified in claims 1 and 6 hereinafter.

Typically, the primary generating modules comprise a power supply or a motor.

The thermally conductive clips preferably comprise metal clips and the thermally conductive platen is preferably made of a good metallic thermal conductor material.

As for the printer, it is typically a liquid-based printer and preferably an ink jet printer.

Preferably, the thermally conductive platen includes means for drying the ink printed on the printing medium thereby providing for faster printing throughput and improved printed quality.

More specifically, in the printer of the present invention, the thermally conductive platen acts as a non-dedicated heat sink. By employing this system and method, the excess heat generated is dissipated by moving the printing medium over the thermally conductive platen. The excess heat is conducted away from the thermally conductive platen through the movement of a corresponding amount of the moving printing medium, the moving printing medium improving air convection cooling over the thermally conductive platen.

As for the printer, it is typically a liquid-based printer, and preferably an ink jet printer.

The heat conductive contacts preferably comprise metal clips. Preferably, the thermally conductive platen includes means for drying the ink printed on the printing medium thereby providing for faster printing throughput and improved print quality. As for the printer, it is typically a liquid-based printer, preferably an ink jet printer.

FIG. 1 is a schematic perspective view of a system for removing excess heat from a printer for printing ink onto a printing medium.

FIG. 2 is a schematic side view of the system of the present invention.

FIG. 3 is a schematic end view of the system of the present invention.

FIG. 4 is an enlarged detailed view of a specific component being heat sinked by a thermally conductive platen.

Referring now to FIG. 1, a system "10" for drying printing ink deposited onto a printing medium 12, typically paper, by a printer (not shown). The printer is employed for printing ink onto a printing medium. The system 10 can be used in any printer. However, it is particularly useful in the GEM printer, a small portable printer manufactured by Hewlett-Packard Company.

The printing medium, which is typically paper 12, is moved through the printer by a rotating shaft 14 driven by an electric motor 16. The shaft and motor have respective intermeshing gears 18 and 20. Thus, gear 18 on shaft 14 is driven by gear 20 disposed on and driven by motor 16. Gear 18, and in turn shaft 14, are driven in a clockwise rotational direction by gear 20, which in turn is driven by motor 16 in a counter clockwise rotational direction.

As paper medium 12 is transferred through the printer it moves over a platen 22, typically a thermally conductive platen, during the printing of the ink on to the printing medium. The thermally conductive platen 22 is rectangular in shape and is typically constructed from a good thermal conductor, particularly a good metallic thermal conductor such as copper or the like. The thermally conductive platen 22 is heated as described below, and the heated platen is used to dry the printing ink on the paper 12.

As best shown in FIGS. 2-4, heat conductive metal clips 24 are attached to the underside of thermally conductive platen 22. The purpose of these clips is to hold the components which are to be heat sinked by thermally conductive platen 22 in heat conductive contact therewith. Thus, transistor 30, which generates excessive heat during use, is held in heat conducted contact by metal clips 24 to thermally conductive platen 22 (see FIG. 4) Transistor 30 is powered by a printed circuit board 26 and is electrically connected to board 26 by wires 28.

In use, the primary the heat generating modules, transistor 30 and power supply 26, respectively, are conductively attached to thermally conductive platen 22 through heat conducted contacts, i.e., metal clips 24. Heat is generated within the printer whenever it needs to print. As the printer is printing and generating heat, paper 12 feeds over the thermally conductive platen 22 which also acts as a heat sink drying the printing ink. Heat is conducted away from the platen through the thermally conductive platen 22 through the moving paper 12. At the same time, the moving paper 12 facilitates convection cooling of the thermally conductive platen 22.

When printing demands increases, more heat is generated within the printer, and more drying capacity is available. Also, more paper 12 will be fed over the thermally conductive platen 22 thereby causing the heat to be removed at a faster rate commensurate with the additional heat being generated.

Having illustrated and described the principles of my invention in a preferred embodiment thereof, it should be readily apparent to those skilled in the art that the invention can be modified in arrangement and detail without departing from such principles. I claim all modifications coming within the scope of the accompanying claims.

## Claims

1. A method for drying ink deposited onto a printing medium (12), which comprises the steps of:

   providing a printer for depositing ink onto said printing medium (12), said printer including a primary heat generating module (30) and a thermally conductive platen (22);
   mounting a thermally conductive clip (24) on the thermally conductive platen (22);
   mounting the primary heat generating module (30) on a printed circuit board (26);
   mounting the primary heat generating module (30) on the clip (24) such that heat from the primary heat generating module (30) is conducted through the clip (24) to the thermally conductive platen (22);
   moving said printing medium (12) into contact with said heated thermally conductive platen (22) so as to thereby heat said printing medium (12);
   depositing said ink onto said heated printing medium (12); and
   drying the ink on said heated printing medium (12),
   the printing medium (12) and the thermally conductive platen (22) acting so as to conduct away heat not dissipated in said ink drying step from the thermally conductive platen (22) through movement of the printing medium (12), the moving printing medium (12) generating a convection current over the thermally conductive platen (22).

2. The method of claim 1, wherein the thermally conductive clip (24) is a metal clip.

3. The method of claim 1 or claim 2, which further includes the step of moving said printing medium (12) over the thermally conductive platen (22) and thereby removing heat build up within the printer, the heat removal rate being commensurate with the rate of heat generation in the printer.

4. The method of any one of claims 1 to 3, wherein the ink comprises a liquid-based ink.

5. The method of any one of claims 1 to 4, wherein the primary heat generating module (30) comprises a power supply or a motor.

6. A printer for depositing printing ink onto said printing medium (12), which comprises

   means for depositing printing ink onto said printing medium (12);
   a thermally conductive platen (22) onto which the printing medium (12) is moved into contact

during deposition of the ink onto the printing medium (12);

a thermally conductive clip (24) mounted on the thermally conductive platen (22); and

a primary heat generating module (30) mounted on a printed circuit board (26),

the primary heat generating module (30) being mounted on the clip (24) such that heat from the primary heat generating module (30) is conducted through the clip (24) to the thermally conductive platen (22) so as to thereby dry said ink on the primary medium (12), and

the printing medium (12) and the thermally conductive platen (22) acting so as to conduct away heat not dissipated during drying of the said ink from the thermally conductive platen (22) through movement of the printing medium (12), the moving printing medium (12) generating a cooling air convection current over the thermally conductive platen (22), which current dissipates heat built up within the printer.

**7.** The printer of claim 6, wherein the thermally conductive clip (24) is a metal clip.

**8.** The printer of claim 6 or claim 7, which further includes means for removing heat build up from within the printer when said printing medium (12) is moved over the thermally conductive platen (22) so that the rate of removal of heat build up is commensurate with the rate of heat generated in the printer.

**9.** The printer of any one of claims 6 to 8, wherein the ink comprises a liquid-based ink.

**10.** The printer of any one of claims 6 to 9, wherein the primary heat generating module (30) comprises a power supply or motor.

**Patentansprüche**

**1.** Ein Verfahren zum Trocknen von Tinte, die auf einem Druckmedium (12) aufgebracht ist, das folgende Schritte aufweist:

Vorsehen eines Druckers zu dem Aufbringen von Tinte auf das Druckmedium (12), wobei der Drucker ein primäres Wärmeerzeugungsmodul (30) und eine thermisch leitfähige Auflageplatte (22) aufweist;

Anbringen einer thermisch leitfähigen Klammer (24) an der thermisch leitfähigen Auflageplatte (22);

Anbringen des primären Wärmeerzeugungsmoduls (30) auf einer gedruckten Schaltungsplatine (26);

Anbringen des primären Wärmeerzeugungsmoduls (30) an der Klammer (24), derart, daß Wärme von dem primären Wärmeerzeugungsmodul (30) durch die Klammer (24) Zu der thermisch leitfähigen Auflageplatte (22) geleitet wird;

Bewegen des Druckmediums (12) in einen Kontakt mit der erwärmten thermisch leitfähigen Auflageplatte (22), um dadurch das Druckmedium (12) zu erwärmen;

Aufbringen der Tinte auf das erwärmte Druckmedium (12); und

Trocknen der Tinte auf dem erwärmten Druckmedium (12),

wobei das Druckmedium (12) und die thermisch leitfähige Auflageplatte (22) wirksam sind, um die Wärme wegzuleiten, die nicht bei dem Tintentrocknungsschritt von der thermisch leitfähigen Auflageplatte (22) durch Bewegung des Druckmediums (12) abgeleitet wurde, wobei das sich bewegende Druckmedium (12) einen Konvektionsstrom über der thermisch leitfähigen Auflageplatte (22) erzeugt.

**2.** Das Verfahren gemäß Anspruch 1, bei dem die thermisch leitfähige Klammer (24) eine Metallklammer ist.

**3.** Das Verfahren gemäß Anspruch 1 oder Anspruch 2, welches ferner den Schritt des Bewegens des Druckmediums (12) über die thermisch leitfähige Auflageplatte (22) und dadurch des Entfernens der Wärme, die sich innerhalb des Druckers aufgebaut hat, aufweist, wobei die Wärmeentfernungsrate der Rate der Wärmeerzeugung in dem Drucker entspricht.

**4.** Das Verfahren gemäß einem beliebigen der Ansprüche 1 bis 3, bei dem die Tinte eine auf einer Flüssigkeit basierende Tinte umfaßt.

**5.** Das Verfahren gemäß einem beliebigen der Ansprüche 1 bis 4, bei dem das primäre Wärmeerzeugungsmodul (30) eine Energieversorgung oder einen Motor aufweist.

**6.** Ein Drucker zum Aufbringen von Drucktinte auf das Druckmedium (12), mit folgenden Merkmalen:

Einrichtungen zum Aufbringen der Drucktinte auf das Druckmedium (12);

einer thermisch leitfähigen Auflageplatte (22), auf die das Druckmedium (12) während des Aufbringens der Tinte auf das Druckmedium

(12) in einen Kontakt bewegt wird;

einer thermisch leitfähigen Klammer (24), die an der thermisch leitfähigen Auflageplatte (22) angebracht ist; und

einem primären Wärmeerzeugungsmodul (30), das auf einer gedruckten Schaltungsplatine (26) angebracht ist,

wobei das primäre Wärmeerzeugungsmodul (30) an der Klammer (24) angebracht ist, derart, daß Wärme von dem primären Wärmeerzeugungsmodul (30) durch die Klammer (24) zu der thermisch leitfähigen Auflageplatte (22) geleitet wird, um dadurch die Tinte auf dem primären Medium (12) zu trocknen, und

wobei das Druckmedium (12) und die thermisch leitfähige Auflageplatte (22) wirksam sind, um Wärme wegzuleiten, die nicht während des Trocknens der Tinte von der thermisch leitfähigen Auflageplatte (22) durch Bewegung des Druckmediums (12) abgeleitet wurde, wobei das sich bewegende Druckmedium (12) einen kühlenden Luftkonvektionsstrom über der thermisch leitfähigen Auflageplatte (22) erzeugt, wobei dieser Strom die Wärme ableitet, die sich in dem Drucker aufgebaut hat.

7. Der Drucker gemäß Anspruch 6, bei dem die thermisch leitfähige Klammer (24) eine Metallklammer ist.

8. Der Drucker gemäß Anspruch 6 oder Anspruch 7, der ferner eine Einrichtung zum Entfernen der aufgebauten Wärme aus dem Inneren des Druckers aufweist, wenn das Druckmedium (12) über die thermisch leitfähige Auflageplatte (22) bewegt wird, derart, daS die Rate der Entfernung der aufgebauten Wärme der Rate der Wärme entspricht, die in dem Drucker erzeugt wird.

9. Der Drucker gemäß einem beliebigen der Ansprüche 6 bis 8, bei dem die Tinte eine auf einer Flüssigkeit basierende Tinte umfaßt.

10. Der Drucker gemäß einem beliebigen der Ansprüche 6 bis 9, bei dem das primäre Wärmeerzeugungsmodul (30) eine Energieversorgung oder einen Motor aufweist.

**Revendications**

1. Procédé pour sécher l'encre déposée sur un milieu d'impression (12), qui comprend les phases consistant à :

préparer une imprimante pour déposer de l'encre sur ledit milieu d'impression (12), ladite imprimante comprenant un module générateur de chaleur primaire (30) et une platine conductrice de la chaleur (22) ;

monter une pince conductrice de la chaleur (24) sur la platine conductrice de la chaleur (22) ;

monter le module générateur de chaleur primaire (30) sur un panneau de circuit imprimé (26) ;

monter le module générateur de chaleur primaire (30) sur la pince (24) de telle manière que la chaleur issue du module générateur de chaleur (30) soit conduite à la platine conductrice de la chaleur (22) à travers la pince (24) ;

faire passer le milieu d'impression (12) en contact avec ladite platine conductrice de la chaleur (22) chauffée de façon à chauffer ledit milieu d'impression (12) ;

déposer ladite encre sur ledit milieu d'impression chauffé (12) ; et

sécher l'encre sur ledit milieu d'impression chauffé (12),

le milieu d'impression (12) et la platine conductrice de la chaleur (22) ayant pour action d'évacuer de la platine conductrice de la chaleur (22) la chaleur qui n'a pas été dissipée dans ladite phase de séchage de l'encre par le mouvement du milieu d'impression (12), le milieu d'impression (12) en mouvement engendrant un courant de convection sur la platine conductrice de la chaleur (22).

2. Procédé selon la revendication 1, dans lequel la pince conductrice de la chaleur (24) est une pince métallique.

3. Procédé selon la revendication 1 ou la revendication 2, qui comprend en outre la phase consistant à faire passer ledit milieu d'impression (12) sur la platine conductrice de la chaleur (22) et, par ce moyen, à évacuer la chaleur dégagée dans l'imprimante, le débit d'évacuation de la chaleur étant adapté au débit de production de chaleur dans l'imprimante.

4. Procédé selon une quelconque des revendications 1 à 3, dans lequel l'encre est constituée par une encre à base liquide.

5. Procédé selon une quelconque des revendications 1 à 4, dans lequel le module générateur de chaleur primaire (30) comprend une alimentation électrique ou un moteur.

6. Imprimante destinée à déposer de l'encre d'impression sur ledit milieu d'impression (12), qui comprend :

des moyens pour déposer de l'encre d'impression sur ledit milieu d'impression (12) ;
une platine conductrice de la chaleur (22) sur laquelle le milieu d'impression (12) est entraîné en mouvement en contact pendant le dépôt de l'encre sur le milieu d'impression (12) ;
une pince conductrice de la chaleur (24) montée sur la platine conductrice de la chaleur (22) ; et
un module générateur de chaleur primaire (30) monté sur un panneau de circuit imprimé (26), le module générateur de chaleur primaire (30) étant monté sur la pince (24) de telle manière que la chaleur dégagée par le module générateur de chaleur primaire (30) soit conduit à la platine conductrice de la chaleur (22) à travers la pince (24) de façon à sécher ainsi ladite encre sur le milieu d'impression (12) ; et
le milieu d'impression (12) et la platine conductrice de la chaleur (22) ayant pour action d'évacuer de la platine conductrice de la chaleur (22) la chaleur qui n'a pas été dissipée pendant le séchage de ladite encre, par le mouvement du milieu d'impression (12), le milieu d'impression (12) en mouvement engendrant un courant de convection d'air refroidissant au-dessus de la platine conductrice de la chaleur (22), lequel courant dissipe la chaleur dégagée dans l'imprimante.

**7.** Imprimante selon la revendication 6, dans laquelle la pince conductrice de la chaleur (24) est une pince métallique.

**8.** Imprimante selon la revendication 6 ou la revendication 7, qui comprend en outre des moyens servant à évacuer de l'intérieur de l'imprimante la chaleur qui s'y est dégagée lorsque ledit milieu d'impression (12) est entraîné en mouvement sur la platine conductrice de la chaleur (22), de manière que le débit d'évacuation de la chaleur dégagée soit adapté au débit de chaleur engendrée dans l'imprimante.

**9.** Imprimante selon une quelconque des revendications 6 à 8, dans laquelle l'encre comprend une encre à base liquide.

**10.** Imprimante selon une quelconque des revendications 6 à 9, dans laquelle le module générateur de chaleur primaire (30) comprend une alimentation en énergie ou un moteur.

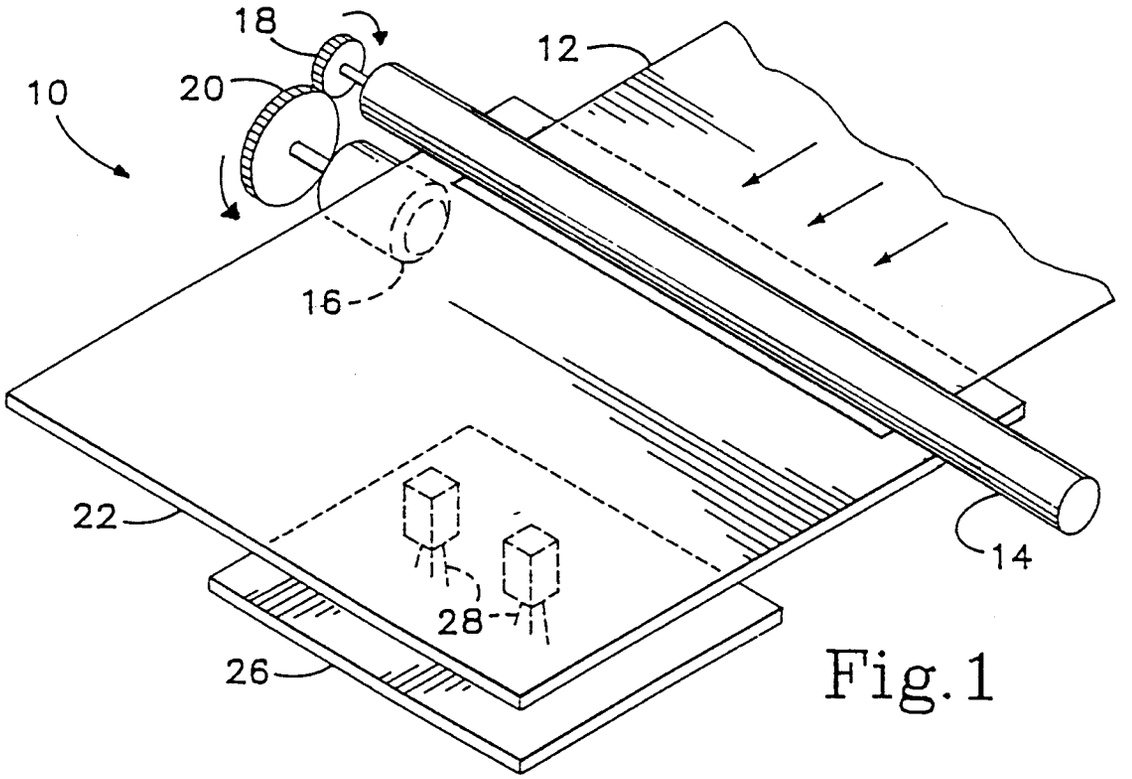


Fig. 1

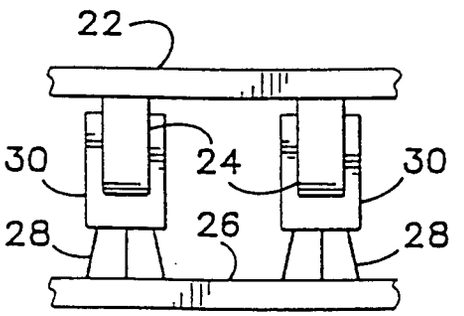


Fig. 2

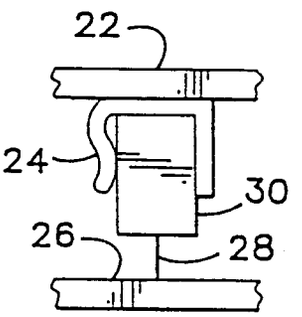


Fig. 3

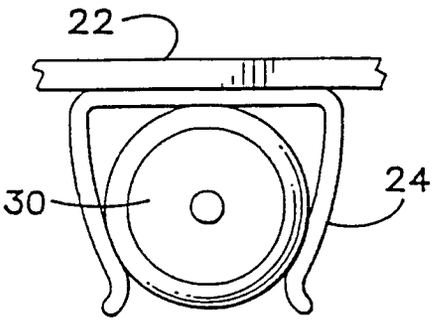


Fig. 4