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PNEUMATIC DELIVERY DEVICE

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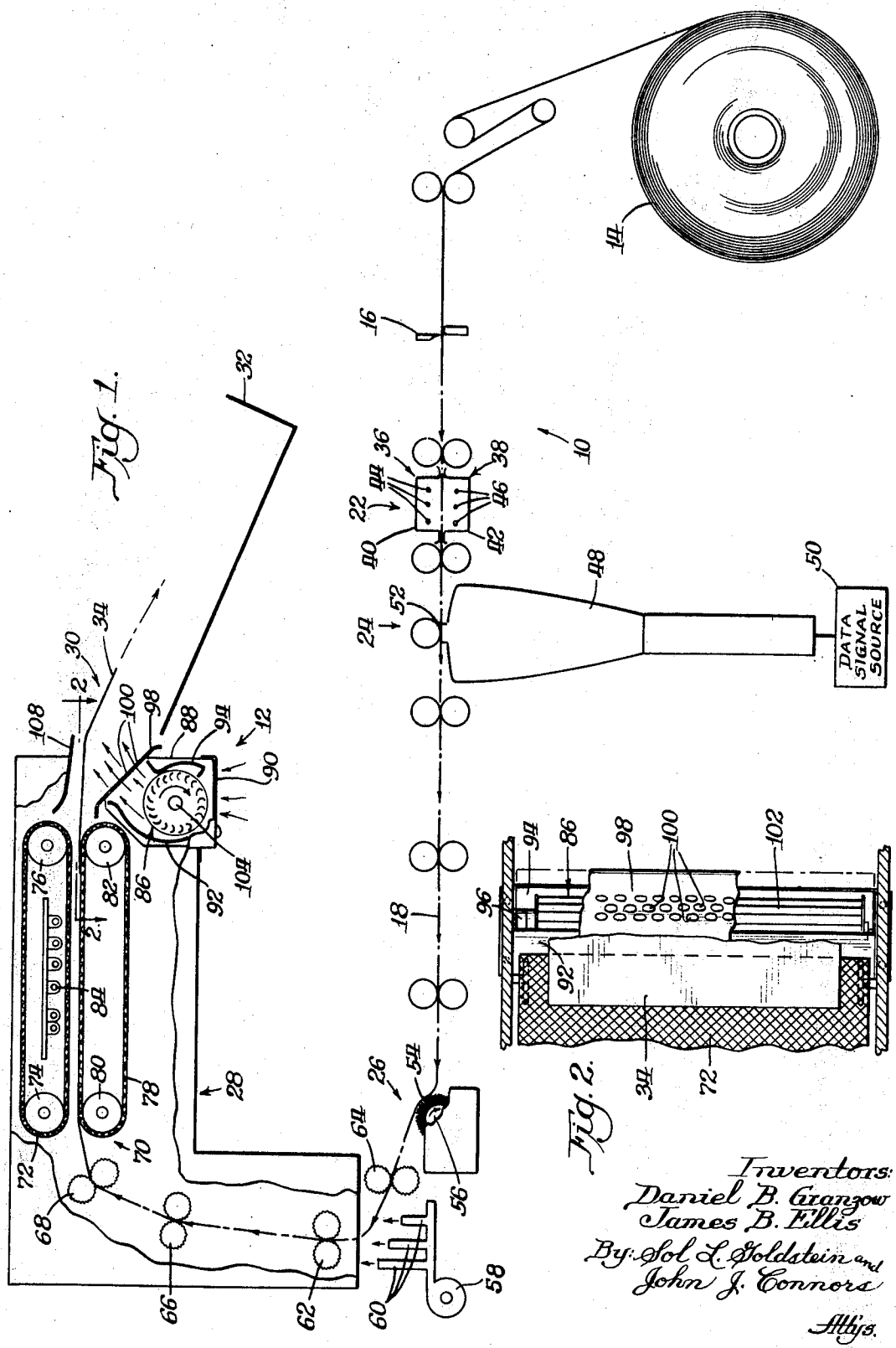


Fig. 1.

Fig. 2.

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PNEUMATIC DELIVERY DEVICE

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ABSTRACT OF THE DISCLOSURE

A pneumatic delivery device for a fuser unit delivers a copy sheet bearing a developed and fused image into a receiving tray at the fuser's exit. An upwardly directed stream of air established by a blower impinges the backside of the copy sheet as it emerges from the exit thereby immediately cooling the sheet and maintaining the general horizontal movement of the sheet as the sheet crosses the span between the exit and tray.

BACKGROUND OF THE INVENTION

This invention relates to an improved fuser unit used in the photoelectrostatic copying art and, more particularly, relates to a pneumatic delivery device for fusers which cools a copy sheet as it emerges from the fuser and guides it into a receiving tray.

As is well known in the photoelectrostatic copying art, a copy sheet having a light sensitive photoconductive layer is uniformly charged and then exposed to an intelligible pattern of light and shadow. The photoconductive layer is discharged in the light struck areas resulting in the formation thereon of a latent electrostatic image. This latent image is converted into a visible form by selectively applying to the sheet a heat responsive developer material, generally a pigmented thermoplastic resin. The developer material, which is attracted to the latent image, is then subjected to heat. The material melts and upon cooling is permanently bonded to the copy sheet.

Machines designed to carry out the above described imaging process employ a fuser unit for melting the developer material. Conventional fuser units are equipped with conveyors which feed the sheet past heating elements and out an exit into a receiving tray. Feed rollers and guides located at the exit advance the sheet and guide it into the tray. When the fuser is operated for prolonged periods, the feed rollers and guides become heated. With the rollers and guides in a heated condition, the softened or molten image on the copy sheet, since it does not have an opportunity to cool as it emerges from the exit, is smeared when it is handled and offsets onto the rollers and guides. This deposit of developer material on the feed rollers and guides is redeposited on the same or subsequently developed sheets. The deposit on the feed rollers and guides also interferes with smooth passage of the sheets therebetween and tends to cause sheet jamming in the fuser unit. If a sheet is detained in the fuser, it is charred or more likely burned. This not only destroys the sheet, but causes a serious fire hazard. Moreover, when copy sheets are fed through the fuser unit in rapid succession and are stacked in the receiving tray, the molten material image acts as a bonding agent which glues the sheets together as they pile one on top of the other.

SUMMARY OF INVENTION

The principle object of this invention is to freely feed a copy sheet from a fuser unit without smearing the developed image thereon or fouling the sheet in the fuser, while simultaneously cooling the developed image. A related object is to eliminate guides and feed rollers at the fuser exit so that the softened developed image will avoid making physical contact with the rollers and guides and thereby not be offset thereon. Another object of this invention is to provide a safe fuser unit which eliminates or reduces the possibility of fire.

In accordance with this invention there is provided a copy sheet processing device comprising means for heating the copy sheet, said heating means having an exit, means for moving the copy sheet through the heating means and feeding said sheet out said exit in a generally horizontal direction, means disposed at the exit for receiving the copy sheet as it emerges from the exit, and means at and below the exit for establishing an upwardly directed stream of air that impinges the backside of the copy sheet as it emerges from the exit to cool the sheet and guide it into the receiving means.

The means establishing the air stream are preferably disposed transverse to the direction of movement of the sheet to provide a stream of air that corresponds to the width of the copy sheet. Such an arrangement effectively cools all the heated areas of the sheet immediately as the sheet leaves the fuser unit.

Control means associated with the air stream establishing means regulate the force with which the air stream strikes the backside of the sheet so that the generally horizontal movement of the sheet is maintained as the sheet crosses the span between the exit and receiving means.

DESCRIPTION OF DRAWINGS

For a better understanding of this invention as well as further features and objects thereof reference is had to the following detail description to be read in conjunction with the accompanying drawings in which:

FIGURE 1 is a schematic illustration of an imaging machine equipped with the pneumatic delivery device of the invention; and

FIGURE 2 is a sectional view taken along line 2—2 of FIGURE 1 with sections broken away.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring to the drawings, and in particular to FIGURE 1, there is shown a photoelectrostatic imaging machine **10** embodying the pneumatic delivery device **12** of this invention. The imaging machine **10** is adapted to make prints on photoelectrostatic sheet material such as, for example, a zinc oxide-resin binder mixture coated on a paper base sheet. Light sensitive material of this type supplied by the roll supply **14** and cut into sheets by the cutter **16** is advanced along a predetermined path **18** by a series of spaced feed rollers sequentially past a charging station **22**, an exposure station **24**, a developing station **26**, a fusing station **28**, out an exit **30** in the fusing station into a receiving tray **32**. The pneumatic delivery device **12** immediately cools the emerging sheet **34** and guides it into the tray **32**.

The charging station **22** is of a conventional design and includes a pair of spaced electrodes **36** and **38** which straddle the path **18**. These electrodes **36** and **38** each respectively comprise shields **40** and **42** which partially surround a series of emission wires **44** and **46**. The copy sheet is fed into the charging station **22** between the electrodes **36** and **38** with the photoconductive coating face down. Since this type of coating more readily accepts a negative sensitizing charge, the emission wires **46** are connected to the negative terminal of a high level D.C. power supply (not shown) while the emission wires **44** are connected to the positive terminal of the power supply. A charging zone is created between the electrodes **36** and **38** which forms a uniform deposit of negative charge on the photoconductive layer of the copy sheet as it passes between the electrodes.

The sheet is next advanced to the exposure station **24** where the charged layer is exposed to a pattern of light and shadow. In accordance with one embodiment of the invention a cathode ray tube **48** is employed to expose the copy sheet. However, several different types of exposure systems can be employed which utilize, for example, projection or contact optical devices that cast a light image corresponding to a graphic original onto the copy sheet. The cathode ray tube **48** is connected to a data signal source **50** such as the output of a computer or a long distance communication link. The electrical data signals are converted by the tube **48** into a scanning light beam, which is displayed on the face **52** of the tube **48**. As the copy sheet moves past the face **52** of the tube **48** the scanning beam sweeps across a narrow transverse segment of the sheet, discharging the sheet in light struck areas to provide a latent electrostatic image corresponding to the data signals.

After being exposed the copy sheet is fed to the developing station **26** where a heat responsive developer material, such as a pigmented thermoplastic resin, is selectively applied to the exposed photoconductive layer to render the latent image visible. The developing station **26** is of the magnetic brush type which employs a mixture of developer material and a magnetically attractable carrier, such as iron particles. The developer material and carrier particles are formed into a brush like configuration **54** on the periphery of a revolving cylinder **56**. As the copy sheet comes into tangential contact with the brush formation **54** the developer material, which has been triboelectrically charged to a positive polarity, is attracted ot the negative image areas on the sheet. Although cascade and liquid developing units can be employed, the preferred developer device is of the type disclosed in U.S. Patent No. 3,003,462.

With the latent image converted to a visible form, the sheet is fed into the fusing station **28**. An air blow turn around device **58**, intermediate the developing station **26** and the fusing station **28**, changes the direction of movement of the sheet while smiultaneously avoiding smearing the unfused developed image which loosely adheres to the surface of the sheet. The exhaust tubes **60** of the turn around device **58** provide a series of air jets which deflect the lead edge of the sheet as it leaves the developing station **26** to change the direction of movement of the sheet and feed the sheet into the nip of the pair of feed rollers **62**. The feed rollers **62**, as well as roller pairs **64**, **66**, and **68**, each are made of a nap material which triboelectrically is compatible with the developer. The nap material selected is widely separated in the triboelectric series from the location in the series of the developer material. Nylon brush type rollers are preferred. When rollers of this type are used, offsetting of the developer material on the rollers is reduced or altogether eliminated. For a detail description of the blower turn around device **58** and the rollers **62**, reference may be had respectively to U.S. Patents Nos. 3,276,452 and 2,894,744.

The sheet is fed by the rollers **62**, **66**, and **68** to a conveyor **70** which moves the sheet **34** out the exit **30** in a generally horizontal direction. The conveyor **70** includes an upper endless belt **72** wound about a drive roller **74** and an idler roller **76**, and a lower endless belt **78** wound about a drive roller **80** and an idler roller **82**. A number of infrared lamps **84**, disposed above the path **18** between rollers **74** and **76** directly over the surface bearing the developed image, emit radiant energy which is transmitted through the belt **72** and absorbed by the developer material. The belts **72** and **78** are made of a flexible chain mesh which permits the radiant energy to be readily transmitted to the copy sheet. With the absorption of radiation by the developed image, the developer material is softened to the point where it can flow and the overall temperature of the sheet is elevated. The belts **72** and **78** are spaced apart from each other to provide a gap of about ¾ of an inch. As a result of the gap the developed surface of the copy sheet **34** does not normally come into contact with the upper belt **72**. However, if the sheet **34** curls, the upper belt **72** prevents the sheet from becoming ensnared in the infrared lamps **84**. The radiant energy output of the lamps **84** and the speed the sheet **34** is fed through the fusing station **28** are controlled so that charring of the sheet is avoided.

In accordance with the principle feature of this invention, the pneumatic delivery device **12** is provided at the exit **30** so that as the sheet **34** proceeds out the exit in a generally horizontal direction, the air stream established by the device **12** cools the sheet and guides it into the tray **32**. The pneumatic delivery device **12** includes a fan **86** mounted below the exit **30** in a position disposed transverse to the direction of movement of the sheet **34**, a housing **88** for the fan having a perforated base **90** and a pair of vertical baffle walls **92** and **94** on opposite sides of the fan which form an air duct, a motor **96** (FIGURE 2), and a diffusion control plate **98** having a plurality of holes **100** therein. As best seen in FIGURE 2, the blades **102** of the fan **86** are slightly longer than the width of the copy sheet **34**. The fan **86** mounted on a drive shaft **104** is driven by the motor **96**. When the motor **96** is turned on the fan **86** is rotated sucking air through the perforations in the base **90** and blowing it upwardly towards the backside of the sheet **34** as it emerges from the exit **30**. The air stream provided by the fan **86** serves as a platform over which the emerging copy sheet **34** rides. Since this platform of air extends across the width of the sheet **34**, all the heated areas of the sheet are immediately cooled as the sheet leaves the fusing station **28**.

The holes **100** in the control plate **98** regulate the force with which the air stream established by the pneumatic delivery device **12** strikes the emerging copy sheet **34** so that the generally horizontal directional movement of the sheet is maintained for the time it takes the sheet to cross the span between the exit **30** and the tray **32**. By varying the number and size of the holes **100** the force of the air stream can be regulated. Alternatively, this force can be controlled by adjusting the rate at which the motor **96** revolves the fan **86**. When about 70% of the sheet **34** has emerged from the exit **30**, the weight of the leading portion of the sheet causes the sheet to fall into the tray **32**. In addition to the cooling and guiding action provided by the air stream at the exit **30**, it also cushions the fall of the sheet and suspends the trailing edge of the sheet as it moves past the span between the exit and tray **32**.

Although the air stream at the exit **30** is controlled so that it will not substantially alter the direction of movement of the sheet **34**, a safety plate **108** mounted at the exit **30** above the path **18** is provided in order to prevent the sheet from becoming fouled at the exit in the event that the pneumatic device **12** has not been properly adjusted for a particular weight of copy sheet.

It is apparent that certain modifications can be made in the copy sheet processing device of this invention without departing from the spirit and scope thereof. Accordingly, the above description and accompanying drawings should be interpreted in an illustrative rather than limiting sense.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. In a device for processing a copy sheet bearing a developed image, said image being rendered permanently fixed to the sheet by the application of heat, the combination including

a fuser for heating the image on the copy sheet, said fuser having an exit;

feeder means associated with the fuser for moving a copy sheet through the fuser and feeding the sheet out the exit in a generally horizontal direction;

a receiving tray disposed at the exit in a position adapted to receive the copy sheet as it is fed from the fuser;

blower means disposed below the exit in a position

transverse to the direction of movement of the copy sheet for establishing an upwardly directed stream of air that provides an air platform which is about as wide as the copy sheet so that as the sheet emerges from the exit substantially all the heated areas of the sheet are immediately cooled; and

control means associated with the blower means for regulating the force the air stream strikes the emerging copy sheet so that the generally horizontal direction of movement of the sheet is maintained as the sheet leaves the exit and moves into the tray.

2. In a machine for imaging a photoelectrostatic copy sheet, the combination including

a charging station for applying a uniform electrostatic charge to the sheet;

an exposure station for exposing the charged sheet to a pattern of light and shadow to produce thereon a latent electrostatic image;

a developing station for selectively applying a heat responsive developer material to the sheet in order to convert the latent image into a visible form, said developer material with the application of heat becoming permanently bonded to the sheet;

a fusing station for heating the sheet and thereby permanently fixing the developer material to said sheet, said fusing station having an exit through which the developed sheet is fed;

a receiving means disposed at the exit in a position adapted to receive the sheet as it leaves the fusing station;

means for moving the sheet along a predetermined path through the machine sequentially past said stations

and feeding the sheet out the exit in a generally horizontal direction;

and means disposed intermediate the exit and receiving means and below said path for establishing an upwardly directed stream of air which impinges against the copy sheet as it emerges from the exit to immediately cool the sheet inlcuding the image thereon and guide said into the receiving means.

3. The machine as set forth in claim **2** including

means associated with the air stream establishing means which regulate the force said stream of air impinges said sheet so that the generally horizontal direction of movement of the sheet is maintained as the sheet moves from the exit to the receiving means.

4. The machine as set forth in claim **2** wherein said air stream establishing means is disposed transverse to the direction of movement of the sheet to provide a stream of air that corresponds substantially to the width of the copy sheet, whereby substantially all the heated areas of the sheet are immediately cooled as the sheet emerges from the exit.

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226—97; 271—86, 88; 355—12, 16