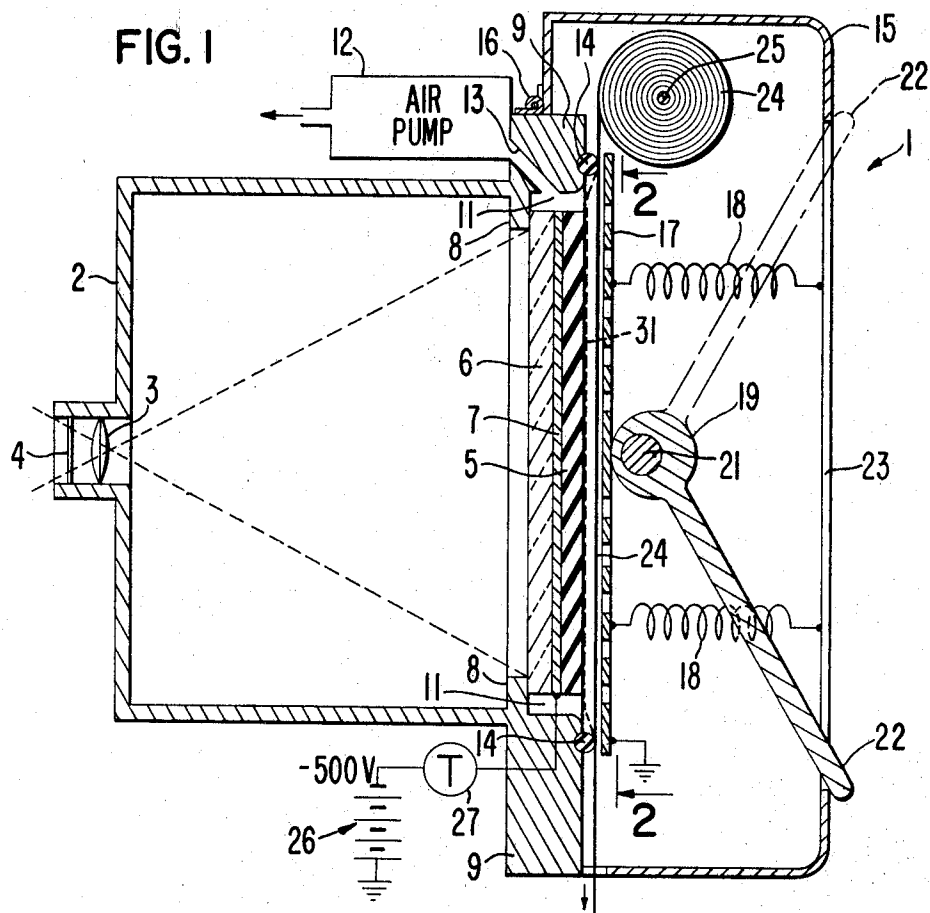
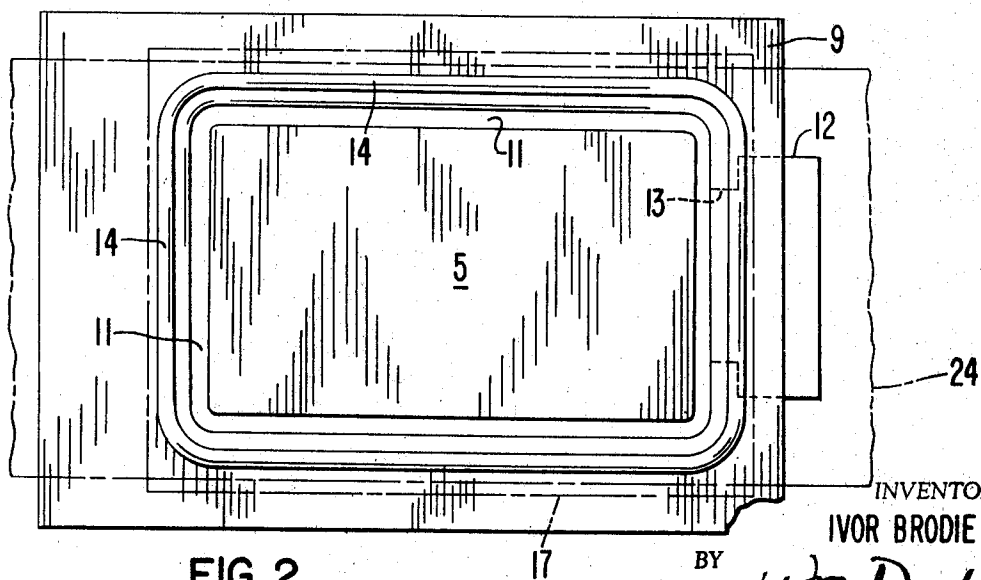


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ELECTROPHOTOGRAPHIC APPARATUS EMPLOYING ATMOSPHERIC
PRESSURE TO HOLD THE FILM IN CONTACT WITH
THE PHOTOCONDUCTOR
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1

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ELECTROPHOTOGRAPHIC APPARATUS EMPLOYING ATMOSPHERIC PRESSURE TO HOLD THE FILM IN CONTACT WITH THE PHOTOCONDUCTOR

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2 Claims

ABSTRACT OF THE DISCLOSURE

In electrophotographic apparatuses, with a photoconductive plate illuminated by a photon image, a vacuum member is positioned to hold the recording medium against the plate. The electrographic recording paper having a charge retentive surface and a conductive backing is placed against the photoconductive plate with the charge retentive surface adjacent the photoconductor. A potential as of 500 v. is applied across the photoconductor and the electrographic paper for a short time during which the photoconductor is illuminated by the photon image to be reproduced. The photoconductor becomes conductive in the regions which are illuminated, thereby causing an electric charge image, corresponding to the image being reproduced or photographed, to be deposited upon the charge retentive surface of the electrographic paper. The charge image is subsequently developed by conventional electrographic toner development methods. During the time the charge image is being deposited on the electrographic paper, the paper is held in nominal contact with the photoconductive plate by drawing a partial vacuum between the photoconductive plate and the electrographic paper such that atmospheric pressure holds the paper against the photoconductor. A groove around the marginal edge of the photoconductive plate is connected to the suction side of an air pump for drawing the partial vacuum between the photoconductive plate and the electrographic paper. A rubber O-ring encircles the groove and a perforated pressure plate clamps the paper against the O-ring to seal the outside marginal edges of the groove to the paper.

DESCRIPTION OF THE PRIOR ART

Heretofore, electrophotographic cameras, and printers have been proposed wherein a photoconductor serves to transform a photo image to be reproduced into a charge image pattern on a charge retentive surface of a sheet or strip of electrographic recording material. An example of such apparatus is described in U.S. Patent 2,825,814 issued Mar. 4, 1958. In this prior art, it is described that the charge retentive surface should preferably be spaced by 1 to 5 microns from the surface of the photoconductor and it was proposed that a fine powder, dusted over the surface of the photoconductor, could help provide the proper spacing.

It has been discovered that the surface roughness of the photoconductor and electrographic paper is sufficient, taken alone, to provide the minute air gap between the photoconductor surface and the charge retentive surface of the recording web when the two are in nominal contact. It has also been discovered that the two surfaces are preferably pressed together into nominal contact over essentially their entire mutually opposed areas in order to

2

assure uniformity in the resultant transfer of charge images to the recording web.

SUMMARY OF THE PRESENT INVENTION

The principal object of the present invention is the provision of an improved electrophotographic apparatus.

One feature of the present invention is the provision, in an electrophotographic device, of means disposed at the marginal edges of the photoconductive imaging plate for drawing a partial vacuum between the plate and the charge retentive surface of a recording web overlaying the plate, whereby atmospheric pressure exerted on the back side of the recording web presses the web into nominal contact with the photoconductive plate to assure uniform charge transfer to the web.

Another feature of the present invention is the same as the preceding feature wherein the means at the marginal edge of the photoconductive plate for drawing the partial vacuum includes a groove encircling the photoconductive plate, such groove being in gas communication with the suction side of an air pump.

Another feature of the present invention is the same as any one or more of the preceding features including the provision of an elastic gasket encircling the marginal edges of the photoconductive plate in cooperative relation with a pressure plate at the backside of the recording web such that when the pressure plate is forced toward the photoconductive plate it serves to make a gas tight seal between the gasket and the web at the marginal edge of the photoconductive plate to permit a partial vacuum to be drawn between the web and the photoconductor.

Other features and advantages of the present invention will become apparent upon a perusal of the following specification taken in connection with the accompanying drawings wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic sectional view of an electrophotographic camera employing features of the present invention, and

FIG. 2 is a sectional view of a portion of the structure of FIG. 1 taken along line 2—2 in the direction of the arrows rotated 90° clockwise with the back of the camera including the paper transport apparatus removed.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIGS. 1 and 2, there is shown an electrophotographic camera 1 employing features of the present invention. The camera 1 includes a dark box 2 having a lens 3 and shutter 4 at one end and a photoconductive plate 5 disposed in the focal plane at the other end of the box 2.

The photoconductive plate 5 is supported from a glass plate 6 via the intermediary of an optically transparent conductive electrode 7 sandwiched therebetween. The glass plate 6 is cemented at its marginal edges to a lip portion 8 of a relatively thick annular metallic flange member 9.

A groove 11 encircles the margin edges of the photoconductive plate 5 and is defined by a space between the surrounding flange 9 and the marginal edges of the sandwiched plate assembly 5 including glass plate 6, electrode 7 and photoconductive plate 5. An air pump 12 has its suction side connected into the groove 11 by means of a gas passageway 13 for drawing a partial vacuum, as of 20 inches of water, on the groove 11. An elastic O-ring

14, as of rubber, encircles the groove 11 and is retained, as by cement, within a shallow groove in the flange 9.

A housing member 15 is hinged to the flange 9 at 16. A perforated conductive pressure plate 17 is carried from the housing 15 via springs 18. A cam 19 is eccentrically pivoted about shaft 21. The shaft is carried at its ends from the housing 15. The cam 19 includes a lever arm 22 which extends out of the housing 15 through a slot 23 therein.

A roll of electrographic recording paper 24 supplies a strip of recording paper which is threaded between the pressure plate 17 and the photoconductive plate 5. The roll of paper 24 is supported on a shaft 25. The shaft 25 is supported at its ends by the housing 15. The electrographic paper comprises an electrically conductive paper backing which supports a thin dielectric film. In a typical example the film is only 4 microns thick. The dielectric film forms the charge retentive surface of the paper 24. The charge retentive film is disposed facing the photoconductive plate 5.

A voltage source 26, as of —500 v., is connected across the photoconductive plate 5 and electrographic paper 24 by having the negative terminal of the supply 26 connected to the conductive electrode 7 and its positive terminal grounded. The pressure plate 17 is also grounded. A timer switch 27 is connected between the negative terminal of the supply 26 and the conductive electrode 7.

In operation, the shutter 4 is closed and a length of paper 24 is pulled from the roll 24 through the housing 15 until an unexposed length of paper 24 overlays the back of the photoconductive plate 5. The air pump 12 is started and the pressure plate lever 22 is moved to the upper position, indicated by phantom lines, to cause the marginal edges of the pressure plate 17 to push the paper 24 against the rubber O-ring 14. This produces a gas tight seal between the paper 24 and the flange 9. The seal encircles the outer marginal edge of the groove 11.

With the seal completed, the air pump 12 draws a partial vacuum, as of 20 inches of water, on the space between the paper 24 and the photoconductive plate 5. The reduced pressure on the photoconductor side of the paper 24 causes atmospheric pressure on the other side of the paper 24 to press the paper flat against the photoconductive plate 5, as indicated by dotted line 31. This pressure produced nominal contact between the charge retentive surface of the paper 24 and the photoconductive plate 5 over essentially the entire area of the plate 5. The presently accepted theory of operation requires a minute air gap, on the order of 10 microns, between the charge retentive surface and the photoconductive surfaces. It is believed that the surface irregularities of the photoconductor 5 and of the dielectric film surface of the paper 24 are of a magnitude on the order of a few microns. Thus, it is believed that these minute surface irregularities prevent the two surfaces from actually coming into complete physical contact and thereby provide the minute air gap. Thus, the term "nominal contact" has been employed to described the contact between these two surfaces and such term is defined to mean that the abutting surfaces have a minute air gap therebetween of on the order of 10 microns.

The partial vacuum drawn on the paper 24 from the edges of the plate 5 assures that no air pockets develop which would otherwise prevent uniform large area nominal contact between the paper 24 and the plate 5. The pressure plate 17 is in electrical contact with the conductive paper backing of the paper 24. The pressure plate 17 may be relatively flexible and a leaf spring, not shown, may be employed between the cam 19 and the pressure plate 17 to provide a larger area of electrical contact with the paper 24.

The camera 1 takes a picture by opening shutter 4 to illuminate the photoconductive plate 5 with the photon image to be reproduced. The timer switch 27 is activated to apply the operating voltage across the photoconductive plate 5 and paper 24. In this process, the photocon-

ductor 5 is rendered conductive in a pattern in accordance with the photon image thereon. The non-illuminated portions of the photoconductor 5 remain non-conductive. The conductive portion of the photoconductor 5 permits a large fraction of the applied voltage to be impressed across the minute air gap and across the dielectric film between the photoconductor 5 and the conductive paper backing of the paper 24. As a result, a charge image, corresponding to the photon image, is transferred to the charge retentive film layer of the paper 24.

After the charge image is deposited on the paper 24 the timer 27 opens the circuit and the shutter 4 is closed. The pressure plate lever is moved to the lower position and the air pump 12 is turned off or preferably reversed. In the case the pump 12 is merely turned off, the atmospheric pressure is released on the paper, permitting the operator to pull the exposed portion of the paper out of the camera housing 15. In the case where the pump 12 is reversed, air pressure greater than atmospheric pressure is produced in the space between the paper and the photoconductive plate, thereby pushing the paper away from the plate. The paper is then pulled through the camera as previously described. Reversing the air pump 12 is preferred because the positive pushing action on the paper breaks the residual electrostatic attraction between the charged paper and the photoconductive plate, thereby preventing abrasion of the photoconductive plate as the paper is pulled from the camera.

The charge image is then developed on the paper 24 by any one of a number of conventional methods employing an electrographic toner. Such methods include liquid toner development and dry powder development.

Although the partial vacuum hold down feature of the present invention has been described as it is used on an electrophotographic camera, its use is not confined to such cameras. It is also useful for radiographic cameras, and microfilm printers employing the same principles of operation. The apparatus of the present invention is useful in any electrophotographic apparatus where nominal contact between a photoconductive member and a charge retentive surface of an electrographic recording web is desired.

Since many changes could be made in the above construction and many apparently widely different embodiments of this invention can be made without departing from the scope thereof it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. In an electrographic apparatus, means forming a photoconductive member onto which a photon image is projected, means for applying a potential across said photoconductor and a separate overlaying flexible electrographic recording web comprising a dielectric charge retentive film supported on a conductive web to produce a charge image on the charge retentive surface of the flexible recording web, the improvement comprising, means at the marginal edge of said photoconductive member for drawing a partial vacuum between said photoconductive member and the charge retentive surface of the electrographic recording web for causing atmospheric pressure at the back side of the web to press the charge retentive surface of said web into nominal contact with essentially the entire mutually opposed area of said photoconductive member, whereby air pockets are prevented from being trapped between said photoconductive member and the electrographic web, and including means for applying greater than atmospheric air pressure to the space between said photoconductive member and the electrographic recording web after the charge image has been transferred to the recording web, whereby the web is pushed by the air pressure away from the photoconductive member to facilitate removal of the web without abrading said photoconductive member.

2. In an electrographic apparatus, means forming a

5

photoconductive member onto which a photon image is projected, means for applying a potential across said photoconductor and a separate overlaying flexible electrographic recording web comprising a dielectric charge retentive film supported on a conductive web to produce a charge image on the charge retentive surface of the flexible recording web, the improvement comprising, means at the marginal edge of said photoconductive member for drawing a partial vacuum between said photoconductive member and the charge retentive surface of the electrographic recording web for causing atmospheric pressure at the back side of the web to press the charge retentive surface of said web into nominal contact with essentially the entire mutually opposed area of said photoconductive member, whereby air pockets are prevented from being trapped between said photoconductive member and the electrographic web, and wherein said means at the marginal edge of said photoconductive member for drawing a partial vacuum includes, means forming an elastic gasket encircling the marginal edge of said photoconductive member and means forming a moveable pres-

6

sure disposed at the back side of the web for forcing the web into pressure contact with said elastic gasket, whereby the marginal edge web is sealed in a gas-tight manner around the marginal edge of said photoconductive member to facilitate drawing the partial vacuum between the web and said photoconductive member.

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