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ELECTROPHOTOGRAPHIC APPARATUS EMPLOYING AN ELASTIC
PRESSURE PAD FOR PRESSING THE FILM
AGAINST THE PHOTOCONDUCTOR
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FIG. 1

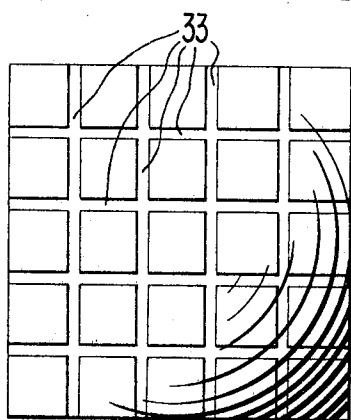
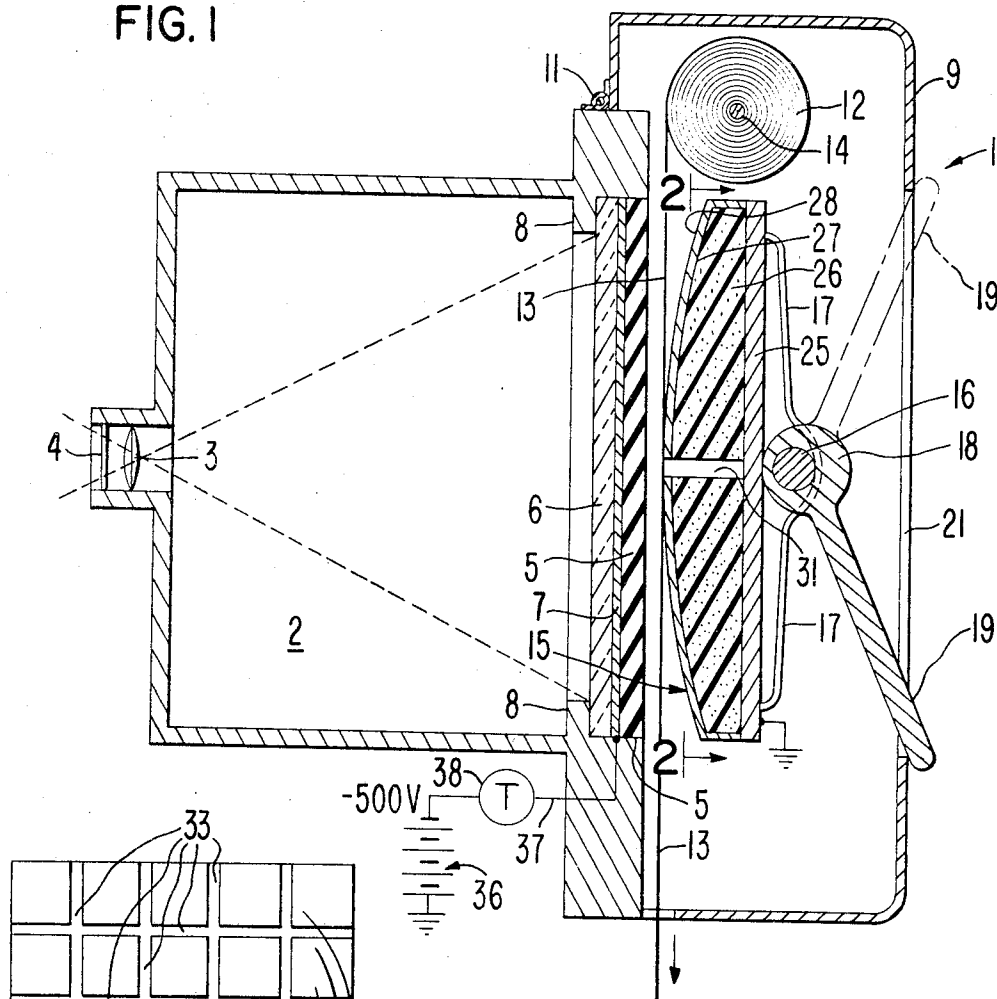


FIG. 3

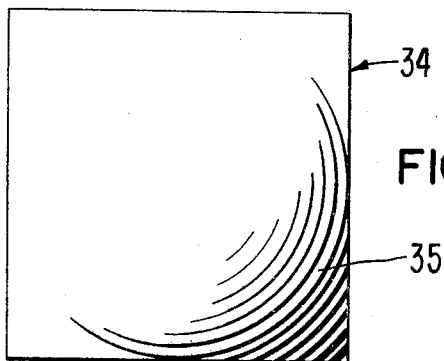
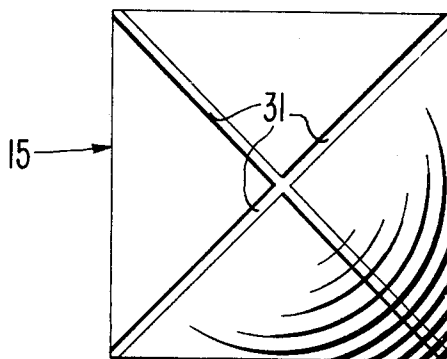


FIG. 4

FIG. 2



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ELECTROPHOTOGRAPHIC APPARATUS EMPLOYING AN ELASTIC PRESSURE PAD FOR PRESSING THE FILM AGAINST THE PHOTOCONDUCTOR

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7 Claims

ABSTRACT OF THE DISCLOSURE

In electrophotographic apparatuses, with a photoconductive plate illuminated by a photon image, an elastic pressure pad holds the recording medium against the plate. The charge retentive surface of an electrographic paper overlays the photoconductive plate. A potential is applied across the photoconductive plate and electrographic paper to deposit an electric charge image corresponding to the photon image on the charge retentive surface of the electrographic paper. The charge image is subsequently developed by conventional methods employing electrographic toner. During deposition of the charge image pattern, the electrographic paper is pressed into nominal contact with the photoconductive plate by means of an elastic pressure pad which has its surface coated with a conductive paint for making electrical contact with a conductive backing of the electrographic paper. The pressure pads are made of sponge rubber and having a thin non-porous skin which is coated with conductive silver paint. The sponge rubber pad portion is cemented to a rigid backing plate. The pads are dome-shaped to squeeze the air out between the paper and the photoconductive plate without trapping the air. The pads are preferably serrated to further prevent trapping of the air bubbles. Alternatively, the soft pressure pad portion may be formed by a flexible plastic or rubber bag filled with a fluid and coated externally with conductive paint.

Description of the prior art

Heretofore, relatively rigid pressure plates have been employed for pressing the charge retentive surface of the electrographic paper into contact with the photoconductive plate in electrophotographic devices. The problem with this arrangement is that small air gaps or bubbles are formed between the photoconductive plate and the charge retentive surface of the electrographic paper. These gaps need only be 0.0005" or greater to prevent formation of a charge image on those portions of the paper which are coextensive with the bubbles. Thus, it has been found that rigid pressure plates are impractical for proper image formation.

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 of a soft elastic pressure pad for pressing the charge retentive surface of an electrographic recording web into nominal contact with the photoconductive imaging member in an electrophotographic device, whereby uniformity of contact between the web and the photoconductor is obtained to assure uniformity in the formation of the charge image on the web.

Another feature of the present invention is the same as the preceding feature wherein a flexible conductive coating is formed on the pressure pad for making electrical contact with the back side of the recording web.

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Another feature of the present invention is the same as any one or more of the preceding features wherein the pressure pad is dome-shaped to facilitate squeezing of air out of the spaces between the photoconductive member and the web.

Another feature of the present invention is the same as any one or more of the preceding features wherein the pressure pad is serrated to prevent trapping of large air bubbles in the spaces between the web and the photoconductive member.

Another feature of the present invention is the same as any one or more of the preceding features wherein the pressure pad is made of sponge rubber with a thin non-porous flexible skin.

Another feature of the present invention is the same as any one or more of the first three features wherein the pressure pad comprises a fluid filled bag.

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 embodying features of the present invention.

FIG. 2 is a view of a pressure pad portion of the structure of FIG. 1 taken along line 2—2 in the direction of the arrows.

FIGS. 3 and 4 are views similar to that of FIG. 2 showing alternative pressure pads of the present invention.

Description of the preferred embodiments

Referring now to FIGS. 1 and 2, there is shown an electrophotographic camera 1 embodying 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 of the lens 3, 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 metal electrode 7 sandwiched therebetween. The plate assembly, comprising glass plate 6, electrode 7 and photoconductive plate 5, is cemented at its marginal edges to a dip 8 of the dark box 2.

A rear housing 9 covers over the rear side of the photoconductive plate 5 and is hinged to the dark box 2 at 11. The rear housing 9 includes a supply roll 12 of electrographic recording paper 13, a strip of which is disposed overlaying the photoconductive plate 5. The electrographic paper comprises a thin film of dielectric coated on a conductive paper backing. The dielectric film forms a charge retentive surface. The roll 12 is mounted on a shaft 14 the ends of which are supported from the side walls of the rear housing 9.

A soft elastic pressure pad assembly 15 is disposed overlaying the photoconductive plate 5 and the electrographic recording paper 13. The pad assembly 15 is carried from a fixed shaft 16 by a plurality of leaf springs 17. The shaft 16 is supported at its ends from the rear housing 9. A cam 18 is eccentrically mounted on the shaft 16 and a cam lever arm 19 extends from the cam 18 out of the housing 9 through a slot 21 therein. When the cam lever 19 is moved to the upper position, as indicated by the dotted lines, the cam 18 pushes the pressure pad assembly 15 into engagement with the recording paper 13 and the photoconductive plate 5.

The pressure pad assembly 15 includes a rectangular backing plate 25, as of 0.125" thick steel plate, to which is affixed, as by cement, a soft elastic pad 26, as of

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sponge rubber 0.563" thick. A thin flexible skin 27, as of non-porous rubber is bonded to and covers over the outer surface of the soft elastic pad such that the sponge material forms the core of the pad assembly 15. A flexible electrically conductive paint 28, as for example silver paint, type SC12 marketed by Micro-Circuits Co., New Buffalo, Mich., is coated over the skin 27 for making electrical contact with a conductive backing on the electrographic recording paper 13.

The pad 15 has a dome-shaped surface which abutts the paper 13 and which is flattened when pushed against the photoconductive plate 5. The purpose of this dome-shape is to permit the pressure pad 15 to squeeze the air, in the spaces between the paper 13 and the photoconductive plate 5, outwardly from the center of the plate 5 toward its edges as the pad 15 is pressed against the paper 13 and the plate 5. This prevents air bubbles from being trapped between the paper 13 and the plate 5. Such air bubbles prevent a nominal contact between the paper 13 and the plate 5 and, thus, prevent uniformity in the charge transfer to the charge retentive surface of the electrographic paper 13.

To further assist in squeezing the air out of the spaces between the paper 13 and the plate 5 without trapping air bubbles, the pad 15 is serrated by a pair of diagonally crossed slots 31. The slots 31 extend across the pad from one corner to an opposed corner and pass through the skin 27 and core 26 to the plate 25. In a typical example, the slots 31 are 0.125" to 0.063" wide.

The slots 31 provide line-shaped regions into which the trapped air can be squeezed, thereby preventing large area bubbles of trapped air which would otherwise produce large blank areas in the charge images deposited upon the recording web 13.

Referring now to FIG. 3, there is shown an alternative pressure pad assembly 32 which is essentially identical to pressure pad 15 of FIGS. 1 and 2 except that the pad is serrated with a rectangular grid array of slots 33. The slots 33 are spaced apart by approximately 1.5" to segment the pad into squares 1.5" on a side.

Referring now to FIG. 4, there is shown an alternative pressure pad assembly 34 of the present invention. In this case, the pressure pad comprises a flat dome-shaped bag 35 made of a flexible elastic skin, as of rubber, and filled with a fluid such as air or water. The bag 35 is cemented on one side to the backing plate 25 and is coated on its other outside surfaces with a conductive flexible paint, such as silver paint, for making electrical contact with the conductive backing of the electrographic recording paper 13.

Referring again to FIG. 1, a potential supply 36 supplies a negative potential, as of -500 V., to one side of the photoconductive plate 5 via lead 37 and transparent electrode 7. A timing switch 38 is connected in the lead 37 for controlling the closed time of the circuit. The other terminal of the supply 36 is grounded as is the backing plate 17 and pad assembly 15.

In operation, the operator pulls an unexposed length of paper from the roll 12 past the photoconductive plate 5 such that the charge retentive dielectric film layer of the electrographic paper 13 is disposed overlaying the photoconductive plate 5. The operator then moves the cam lever 19 to the upper position, indicated by dotted lines, to press pressure pad assembly 15 against the paper 13 and, thus, the charge retentive surface of the paper 13 into nominal contact with the photoconductive plate 5.

According to the presently accepted theory for charge transfer to the charge retentive surface of the paper 13, it is believed that a minute air gap, on the order of a few microns, is required between the photoconductive plate 5 and the charge retentive surface of the paper 13. However, the photoconductive plate 5 and the thin, as of 4 microns thick, dielectric charge retentive film of the paper have surface irregularities on the order of a few microns high. Thus, these surface irregularities are believed to

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provide the necessary air gap even though the two surfaces are pressed together. Thus, the term "nominal contact" has been employed herein to describe the contact between the two surfaces which permits the existence of a minute air gap on the order of a few microns wide therebetween.

Once the recording paper has been pressed into nominal contact with the photoconductive plate 5, the shutter 4 is opened to permit the photon image, to be reproduced, to illuminate the photoconductive plate 5. Simultaneously, the timer switch 38 is activated for a certain exposure time to apply the charge transfer potential across the photoconductive plate 5 and the dielectric film of the recording paper 13. The applied potential causes a charge image, corresponding to the photon image on the photoconductive plate 5, to be deposited on the charge retentive film of the recording paper 13. After the charge image has been formed, the timer 38 opens the circuit and the shutter 4 is closed. The operator places the cam lever 19 in the lower position to release the pressure on the paper 13 such that the exposed paper 13 may be pulled from the housing 9 for subsequent development by conventional electrographic toner methods. Such methods include either those employing liquid toner or dry powdered toner.

Use of the soft elastic pressure pads 15, 32 or 34 assures a uniform nominal contact over the entire area of the photoconductive plate 5, thereby preventing large unprinted regions in the developed prints.

Although the pressure pad feature of the present invention has been described, for simplicity of explanation, as it is employed in an electrophotographic camera 1, it is equally applicable to other electrophotographic devices such as, for example, microfilm printers and radiographic cameras.

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 electrophotographic apparatus, means forming a photoconductive imaging member, means forming an electrographic recording web having a thin dielectric charge retentive film formed on a conductive web, means for applying a potential across said recording web and said photoconductive member for depositing a charge image upon the charge retentive surface of the recording web overlaying said photoconductive member under the influence of the electrical potential applied across said photoconductive member and the recording web, means for pressing the charge retentive surface of the recording web against said photoconductive member, the improvement wherein, said means for pressing the recording web against said photoconductive member includes a soft elastic pressure pad disposed overlaying said photoconductive member and having a surface area overlaying said photoconductive member which is substantially coextensive with the image area to be deposited on said web for pressing the charge retentive surface of the web against said photoconductive member over substantially the entire image area, whereby uniform nominal contact is obtained between the charge retentive surface of the recording web and said photoconductive member, and said means for applying an electrical potential across said recording web and said photoconductive member including a flexible conductive coating on the surface of said soft pressure pad disposed overlying said electrographic recording web for being pressed into electrical contact with said conductive web portion of said recording web by said pressing means.

2. The apparatus of claim 1 wherein the pressure pad is dome-shaped to facilitate squeezing of the air out of

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the spaces between said photoconductive member and the recording web.

3. The apparatus of claim 1 wherein said pressure pad is serrated in a grid pattern to prevent trapping of large air bubbles in the spaces between the recording web and said photoconductive member. 5

4. The apparatus of claim 1 wherein said soft elastic pressure pad comprises, a soft elastic core, and a flexible skin covering over said elastic core.

5. The apparatus of claim 4 wherein said soft core is a spongy material. 10

6. The apparatus of claim 4 wherein said soft core is a fluid under pressure.

7. The apparatus of claim 1 including, means forming a backing plate member to which said soft elastic pressure pad is affixed. 15

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