United States Patent [19]

Paull

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[45] **Jan. 16, 1973**

[54] PRESSURE TRANSFER MECHANISM

[75] Inventor: **Michael H. Paull,** Mountain View, Calif.

[73] Assignee: **Photophysics, Inc.,** Mountain View, Calif.

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[52] **U.S. Cl.** **355/16,** 355/72, 355/128, 355/130

[51] **Int. Cl.**.....**G03b 27/04,** G03b 15/00

[58] **Field of Search**.....355/3, 16, 72, 91, 116, 118, 355/120, 128, 129, 130, 131; 95/68, 69

[56] **References Cited**

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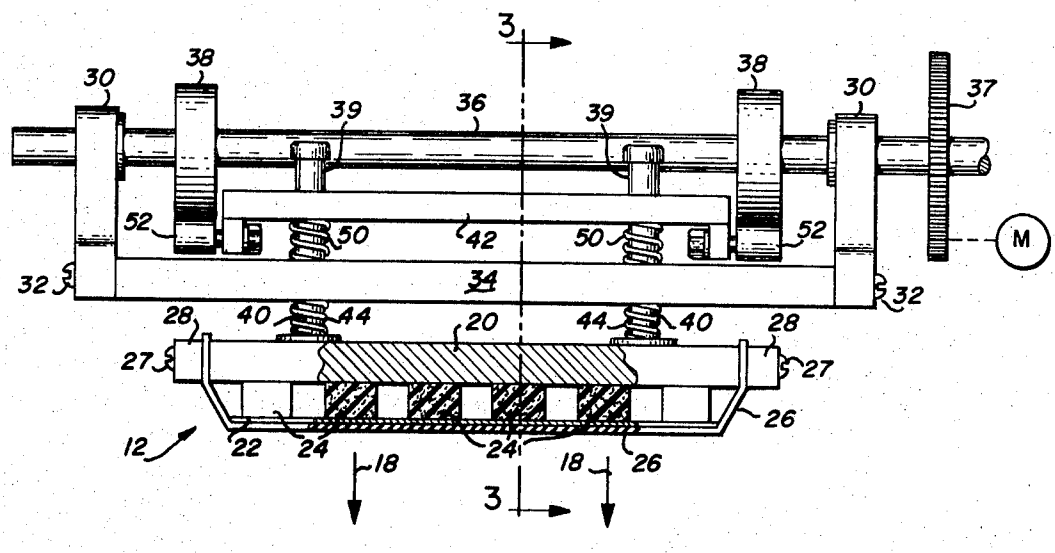
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Primary Examiner—Robert P. Greiner
Attorney—Lowhurst & Hamrick

[57] **ABSTRACT**

A pressure transfer mechanism is disclosed for applying evenly distributed pressure to a sheet of flexible photocopy paper overlying a planar surface of a photoconductor in an electrostatic photocopy image transfer station. The mechanism comprises a frame to which the photoconductor is rigidly held and a movable plate mounted for movement with respect to the frame and the photoconductor. A platen is disposed between the movable plate and the photoconductor which platen has a planar surface disposed adjacent and substantially parallel the photoconductor planar surface. A first set of compression springs is sandwiched between the movable plate and the frame. A second set of compression springs is sandwiched between the platen and the movable plate.

8 Claims, 4 Drawing Figures



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SHEET 1 OF 2

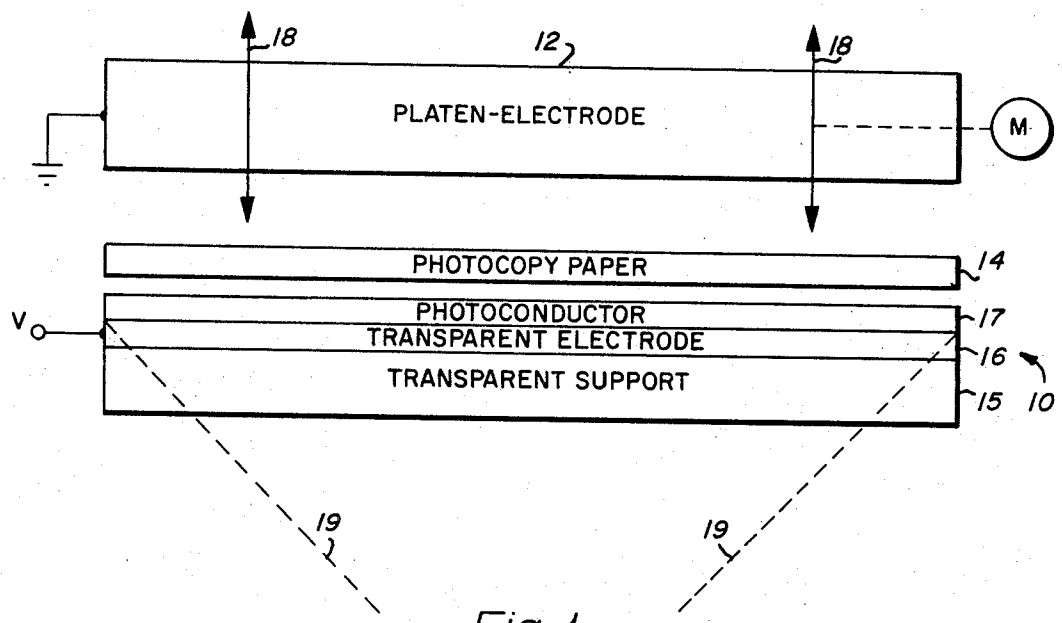


Fig_1

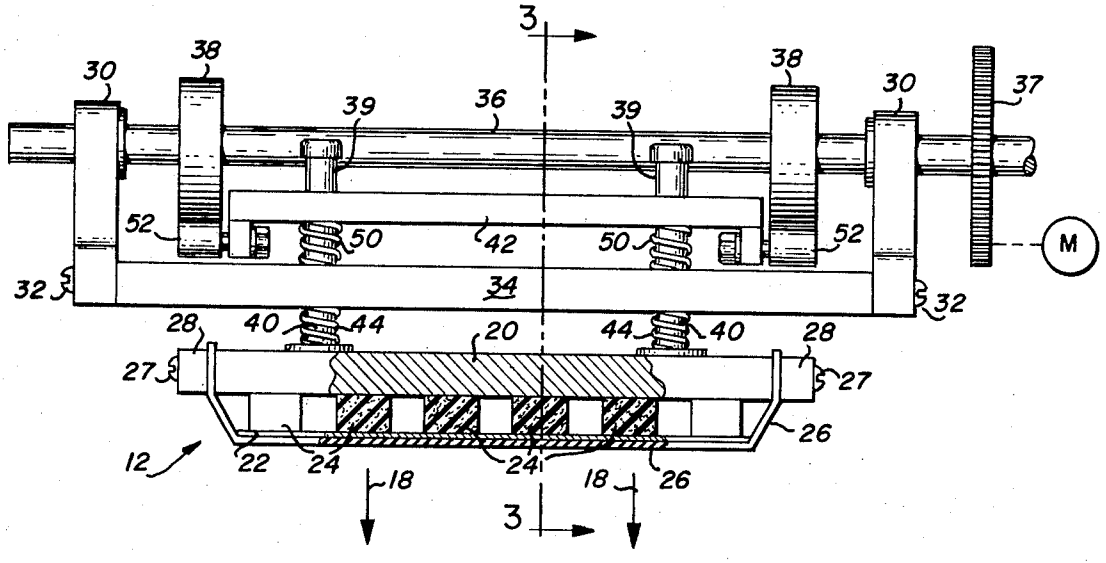


Fig_2

INVENTOR.
MICHAEL H. PAULL
BY
Lowhurst & Hamsick
ATTORNEYS

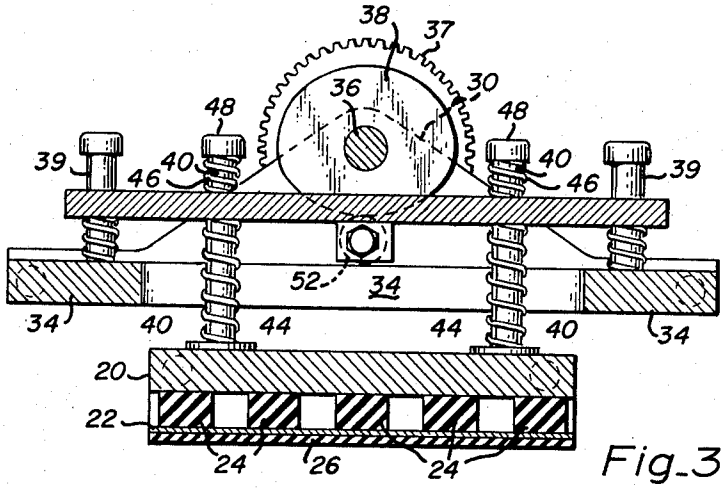


Fig_3

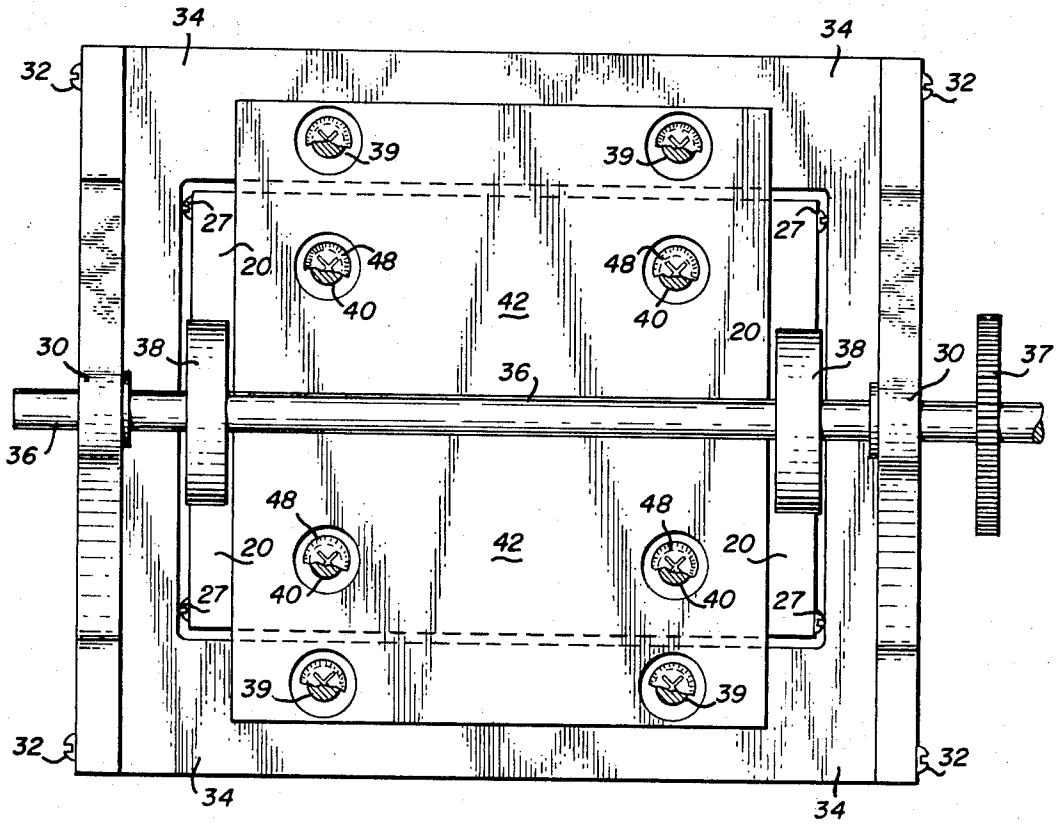


Fig_4

INVENTOR.
MICHAEL H. PAULL
BY
Lowhurst & Hamrick
ATTORNEYS

PRESSURE TRANSFER MECHANISM

BACKGROUND OF THE INVENTION

This invention refers generally to electrostatic photocopiers, and more specifically to means for transferring an electrostatic image from the surface of a photoconductor to the surface of a sheet of photocopy paper overlying the photoconductor in an image transfer station.

In some types of electrostatic copies an optical image is projected onto one surface of a planar, photoconductive plate, and a sheet of photocopy paper is positioned against the other surface thereof. In such cases, the photoconductive plate typically comprises a transparent support upon one planar surface of which is deposited a thin layer of a transparent, electrically-conductive oxide such as Nesa or Nesatron. A layer of photoconductive material is in turn deposited on the layer of conductive oxide. Ideally, the exposed surface of the photoconductive layer would be absolutely planar as would be the sheets of photocopy paper placed thereon whereby abutment of the photoconductor and paper would be complete over their entire area of desired contact. In actuality, however, such perfection is rarely, if ever, achieved. This is largely due to cost factors. Thus, the transparent support is typically a sheet of ordinary plate glass, preferably Pyrex which is heat resistant. To use smoother glass such as that found in optical astronomy would usually be cost prohibitive. In addition, in coating the glass substrate with the conductive oxide which provides a transparent electrode, and in coating the conductive oxide with photoconductive material the photoconductive plate must ordinarily be heated. This application of heat introduced certain gradual, gross surface distortions in the nature of slight warping. Furthermore, the outer surface of the layer of photoconductive material itself has local, contour imperfections. As a consequence the exposed surface of most photoconductive plates are merely approximately rather than absolutely planar. Likewise, the flexible photocopy paper, which typically has a thin coating of dielectric plastic on the side facing the photoconductive plate, is only approximately planar when so supported.

For proper transfer of an electrostatic image on the surface of the photoconductive plate to a surface of the dielectrically coated sheet of paper which has been placed in position overlying the plate, the entire areas of the two confronting surfaces should be in abutment. Otherwise, some areas of the electrostatic image may be transferred to a less extent than other areas. Whether such abutment under operating conditions is actual or virtual has been open to argument, but in any event the entire areas of these two confronting surfaces should be under uniform, convergent pressure for proper charge transfer to be effected.

In earlier electrostatic copiers of the type described, such evenly distributed pressure was achieved by sheer brute force. Such, however, did not provide satisfactory inasmuch as photoconductors in general use today are easily damaged when subjected to pressure in significant excess of one atmosphere. Later, such pressure distribution was achieved through the use of powdered spacers. Recently, vacuum devices, such as that disclosed by U.S. Pat. No. 3,506,348, were so used. However, in none of these devices of the prior art was a

uniform, relatively low pressure achieved in a simple manner.

Accordingly, it is a principal object of the present invention to provide a pressure transfer mechanism for applying evenly distributed pressure to a flexible sheet of paper overlying a substantially planar surface of a photoconductor in an electrostatic photocopy image transfer station.

SUMMARY OF THE INVENTION

Briefly described, the present invention is a pressure transfer mechanism for applying evenly distributed pressure to a sheet of flexible photocopy paper overlying a planar surface of a photoconductor in an electrostatic photocopy image transfer station. The mechanism comprises a frame to which the photoconductor is rigidly held and a movable plate mounted for movement with respect to the frame and the photoconductor. A platen is disposed between the movable plate and the photoconductor which platen has a planar surface disposed adjacent and substantially parallel the photoconductor planar surface. A first set of compression springs is sandwiched between the movable plate and the frame. A second set of compression springs is sandwiched between the platen and the movable plate.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1. is a diagrammatical view of elements defining an image transfer station of an electrostatic photocopier in which a pressure transfer mechanism incorporating principles of the present invention may be used.

FIG. 2. is an elevational view of a pressure transfer mechanism incorporating principles of the present invention.

FIG. 3 is a side view of the apparatus shown in FIG. 2 taken in cross section along plane 3—3.

FIG. 4 is a plan view of the apparatus shown in FIGS. 2 and 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now in more detail to the drawing, there is diagrammatically shown in FIG. 1 a photoconductive plate **10** and a platen **12** spaced therefrom to define an electrostatic image transfer station. A sheet of flexible photocopy paper **14** is shown positioned in the image transfer station. The side of the photocopy paper disposed adjacent the photoconductive plate is coated with a dielectric material such as plastic whereby it may well retain a latent electrostatic image transferred thereon from the photoconductive plate. The photoconductive plate is seen to comprise a transparent support **15** such as plate glass upon which is coated a thin layer of a transparent conductive oxide **16** such as Nesa or Nesatron. A layer of photoconductive material **17** is in turn coated on the conductive oxide layer. Platen **12** and transparent, conductive oxide layer **16** of photoconductive plate **10** are electrically coupled across a voltage source V and thus function as image transfer station electrodes. Platen **12** is also mechanically linked to a motor M Whereby it may be driven towards and away from photocopy paper **14** as indicated by arrows **18**.

In operation, a sheet of photocopy paper is brought into the image transfer station with platen **12** spaced from photoconductive plate **10**. Motor M then drives platen **12** towards the photoconductive plate sandwiching photocopy paper **14** therebetween under compressive force. With platen **12** and transparent electrode **16** coupled across a voltage source V an optical image is projected by means of light beam **19** through transparent support **15**, transparent electrode **16** and onto photoconductor **17**. The photoconductor converts the optical image on its side in contact with transparent electrode **16** to an electrostatic image on its side in contact with the photocopy paper. In this manner, the electrostatic image is transferred to the dielectrically coated surface of the photocopy paper. Platen **12** is then driven by motor M away from photoconductive plate **10** and photocopy paper **14** is then removed. Alternatively, the photoconductive plate could be driven away from the platen. Subsequently, the latent electrostatic image on photocopy paper **14** is toned and fixed and thereby rendered visible.

In FIGS. **2** and **3**, platen **12** is shown together with a pressure transfer mechanism incorporating principles of the present invention. The platen itself is seen to comprise a base plate **20** and a thin, planar, metallic support **22** spaced therefrom parallel to the base plate. Sandwiched between base plate **20** and support **22** are 30 mutually spaced columns of slightly compressed sponge rubber **24** arranged in a checkerboard pattern. The ends of each sponge rubber column are preferably glued to base plate **20** and to support **22**. A sheet of conductive rubber **26** is stretched over the surface of planar support **22** facing outwardly from columns **24** and clamped to the sides of base plate **20** by means of screws **27** and bars **28**.

The platen drive mechanism, which includes a pressure transfer mechanism, is seen to comprise two pillow blocks **30** mounted by means of screws **32** to a hollow frame **34**. Shaft **36** is journaled through pillow blocks **30**. Gear **37** is attached to shaft **36** which gear is in turn linked by a chain, not shown, to motor M. Two spaced plastic cams **38** are rigidly secured to shaft **36** between pillow blocks **30**. Four cylindrical posts **39** are mounted to frame **34**. Four additional cylindrical posts **40** are mounted to base plate **20** of platen **12**. Both posts **39** and **40** slidably extend through Oilite bushings in apertures within movable plate **42**. Four relatively strong springs **44** are mounted about post **40** between the platen and movable plate **42**, and four small noise abatement springs **46** are likewise mounted about posts **40** between movable plate **42** and shoulder screws **48**. Four relatively weak springs **50** are mounted about posts **39** between frame **34** and movable plate **42**. Herein by the terms "strong" and "weak" in describing spring strength is meant that for a given force a strong spring is compressed a distance less than that of a weaker spring. Finally, two cam followers **52** are rotatably mounted to movable plate **42** in part by means of two nuts **54**.

FIGS. **2** and **3** depict the platen in a raised position out of contact with photoconductive plate **10** whereby photocopy paper **14** may be inserted into the image transfer station. Upon command for platen **12** to move against the photocopy paper and the photoconductive plate as shown by arrows **18**, shaft **36** will be rotated by motor M. This action will in turn cause cams **38** to revolve and push cam followers **52** downwardly in the direction of arrows **18**. As the cam followers are rotatably attached to movable plate **42**, the movable plate will likewise move downwardly compressing relatively weak springs **50**. Platen **12** will then engage photocopy paper **14** and press it against photoconductive plate **10**. At this point, a slight further movement of the platen against the photocopy paper and photoconductive plate by rotation of cams **38** will cause compression of sheet **26** of conductive rubber, compression of columns **24** of sponge rubber, compression of relatively strong springs **40**, and compression of relatively weak springs **50**. Continued rotation of shaft **36** and cams **38** will permit movement of platen **12** away from photoconductive plate **10** by the face of the compressed springs and return the platen to its original position illustrated in the drawing with respect to frame **34**.

It should be understood that the described embodiment is merely illustrative of applications of the invention and that many modifications may be made thereto without departure from the spirit and scope of the invention as set forth in the following claims.

What is claimed is:

1. A pressure transfer mechanism for applying evenly distributed pressure to a sheet of flexible photocopy paper overlying a planar surface of a photoconductor in an electrostatic photocopy image transfer station, said pressure transfer mechanism comprising:

a frame to which said photoconductor is rigidly held;

a movable plate mounted for movement with respect to said photoconductor;

a platen disposed between said movable plate and said photoconductor and having a planar surface disposed adjacent and substantially parallel said photoconductor planar surface;

first compressive spring means sandwiched between said movable plate and said frame;

second compressive spring means sandwiched between said platen and said movable plate; and

means incorporated with said frame for reciprocally moving said movable plate, whereby downward motion of said movable plate moves said movable plate against the pressure of said first compressive spring means and moves said platen against said photocopy paper against the pressure of said second compressive spring means.

2. A pressure transfer mechanism in accordance with claim **1** wherein said first compressive spring means comprises a first set of compression springs, and wherein said second compressive spring means comprises a second set of compression springs.

3. A pressure transfer mechanism in accordance with claim **2** wherein said movable plate has first and second sets of apertures therein and wherein said mechanism further comprises:

a first set of posts mounted to said frame and extending into said first set of apertures in said movable plate; and

a second set of posts mounted to said platen and extending into said second set of apertures in said movable plate.

4. A pressure transfer mechanism in accordance with claim **3** wherein said first set of springs are sandwiched

between said movable plate and said frame about said first set of posts, and said second set of springs are sandwiched between said platen and said movable plate about said second set of posts.

5. A pressure transfer mechanism in accordance with claim 2 wherein each spring of said first set of springs is of substantially the same strength, and wherein each spring of said second set of springs is also of substantially the same strength.

6. A pressure transfer mechanism in accordance with claim 5 wherein each spring of said first set of springs is substantially weaker than each spring of said second set of springs.

7. A pressure transfer mechanism in accordance with claim 6 wherein said movable plate is rectilinear and has a geometric center, and wherein said first set of springs includes four springs located substantially equidistantly from said geometric center.

8. A pressure transfer mechanism in accordance with claim 7 wherein said second set of springs includes four springs located substantially equidistantly from said geometric center a distance less than the distance said four springs of said first set of springs are located from said geometric center.

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