United States Patent

Yamanoi

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[54] **EXPOSURE WINDOW OF AN ELECTROSTATIC COPYING MACHINE**

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[52] **U.S. Cl.**.....**355/3**

[51] **Int. Cl.**.....**G03g 15/04**

[58] **Field of Search**.....355/3, 103, 108

[56] **References Cited**

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[57] **ABSTRACT**

An exposure window in an electrostatic copying machine for preventing electrostatic adherence of the advancing copy paper is formed of a flat transparent plate having deep wells in its rear face including a medial equilateral triangular well with its apex toward the plate trailing edge and a group of parallelogram wells on each side of the triangular wells, the wells being separated by thin partitions with parallel walls. The peripheral faces of the wells are perpendicular to the plate faces and the bases of the wells are parallel to the plate faces. The window plate has a guide slope formed on one edge for guiding the entry of a copy paper onto the plate for exposure.

8 Claims, 6 Drawing Figures

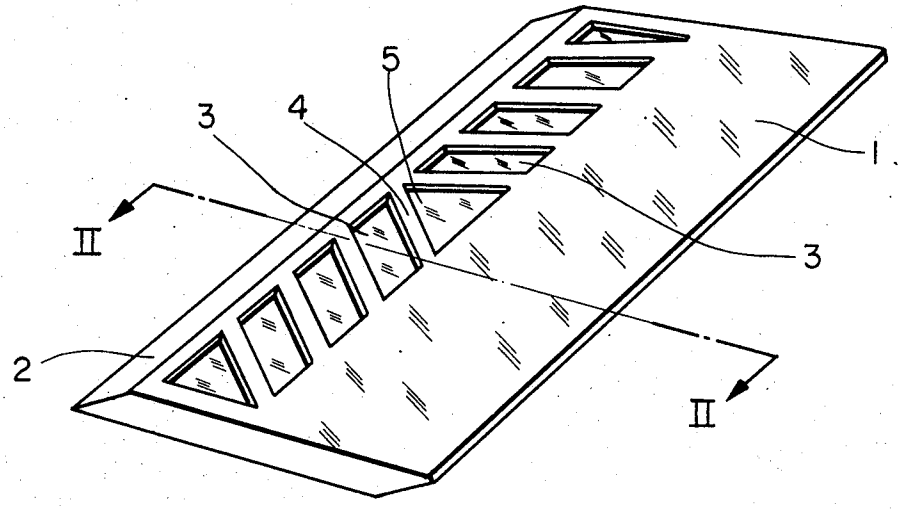


FIG. 1

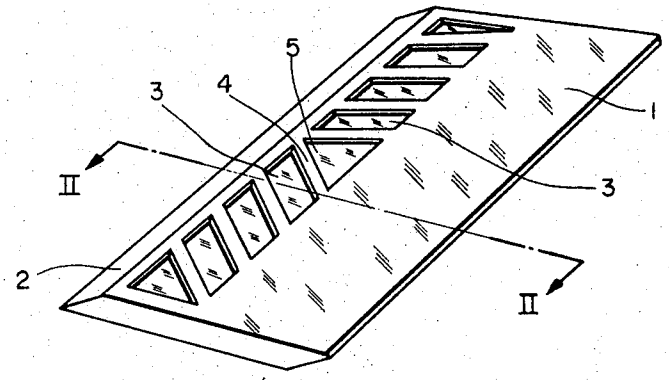
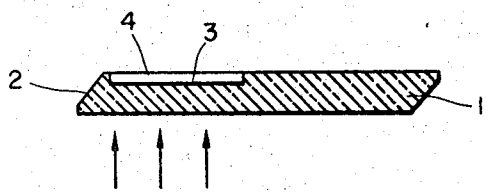


FIG. 2



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FIG.3

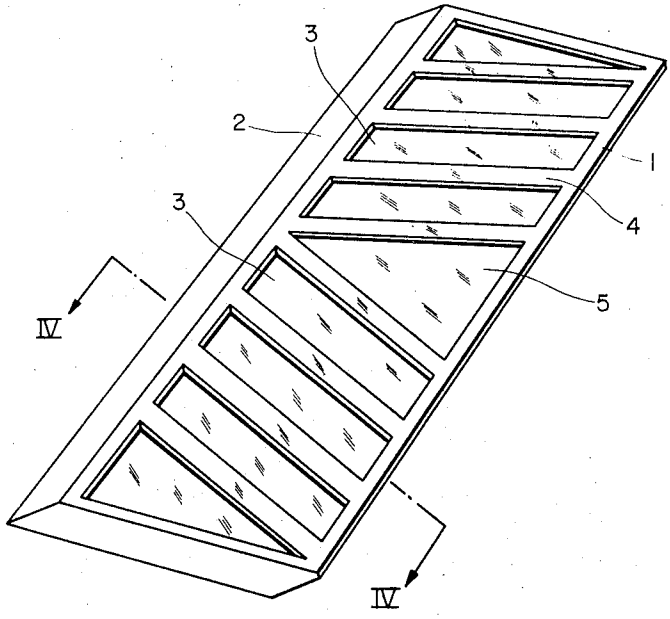
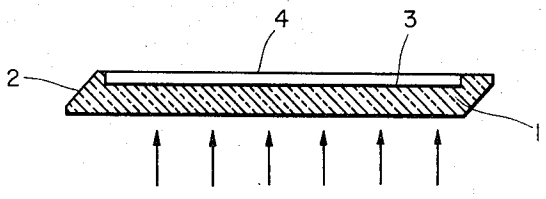


FIG.4



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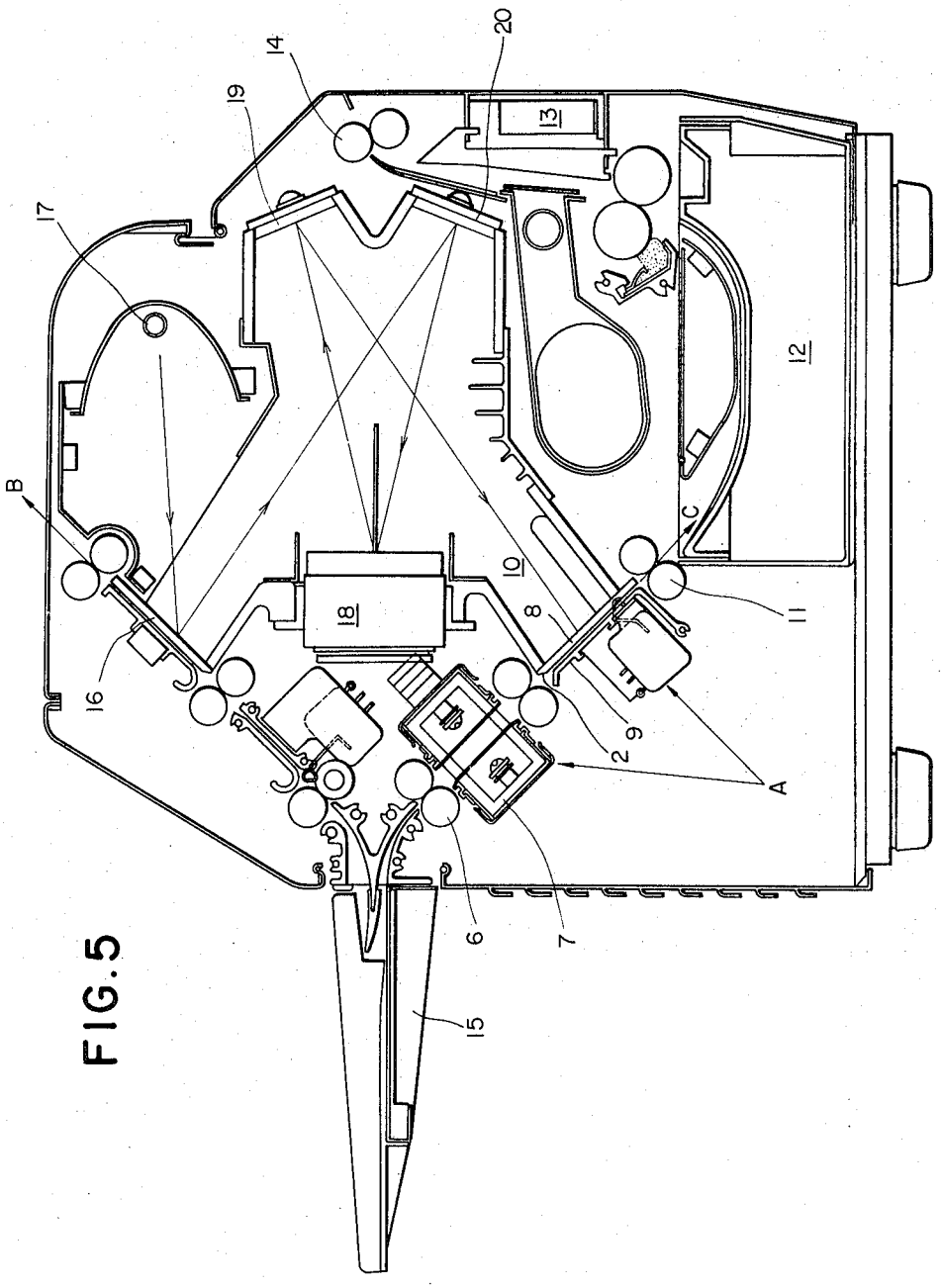
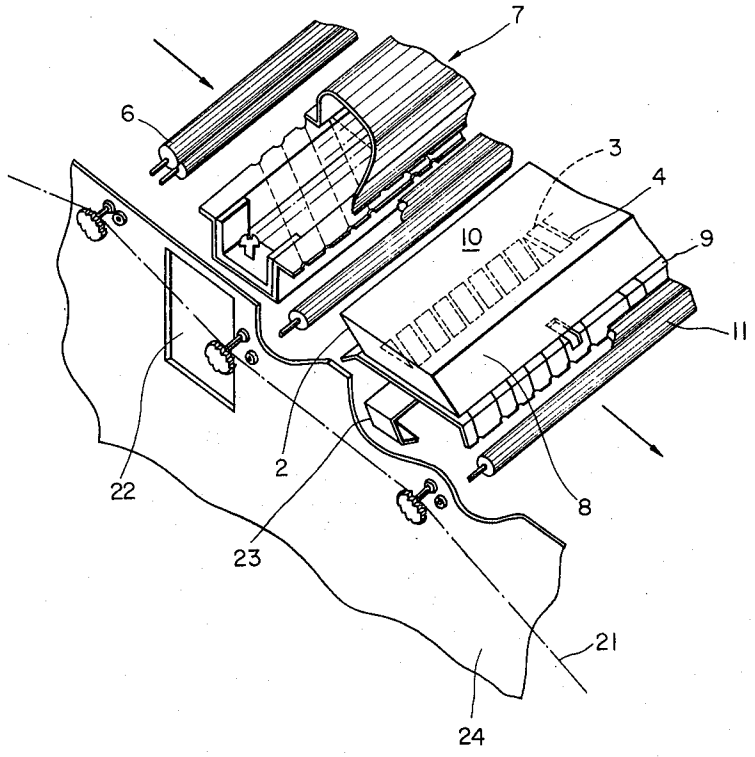


FIG. 5

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FIG.6



EXPOSURE WINDOW OF AN ELECTROSTATIC COPYING MACHINE

This invention relates to an exposure window for an electrostatic copying machine, and more particularly to an exposure window for an electrostatic copying machine in which a copying paper coated with zinc oxide (ZnO) powder or the like is negatively charged prior to the exposure to an image so that the paper thus exposed is developed, dried, and fixed for completing a copying operation. According to the present invention, there is provided an exposure window of a slit exposure type electronic copying machine, which window is to be disposed on the passage of photosensitized copying paper at an exposing portion of the machine and consists of a transparent plate, e.g., a transparent glass or acrylic resin plate, characterized in that the exposure plate has a guide slope formed one edge thereof and includes a reference recess and two series of recesses disposed on opposite sides of the reference recess along a line perpendicular to the passage of the photosensitized paper, all the recesses being recessed from a first surface of the exposure window which faces the photosensitive paper, the shapes and the disposition of the recesses being such that the non-recessed portions of the first surface between adjacent recesses on each side of the reference recess extend away from the axial center line of the travelling direction of the photosensitized paper as the non-recessed portions extend in the travelling direction of the photosensitized paper.

Generally speaking, in the exposing mechanism of a known electrophotographic copying machine, an electrostatic charger is disposed between a first and a second paper feeding rollers, and an exposing portion is defined between the second paper feeding roller and a third paper feeding roller by assembling a transparent plate and a bearing plate, which rollers transfer each exposed copying paper to a developing portion. The charger consists of a pair of electrodes, which are spaced from each other by a distance slightly larger than the thickness of the copying paper, and it is intended to pass the copying paper through the space between the electrodes and feed it toward the second paper feeding roller along a rectilinear path. If the copying paper is not spanned straightly between the first and the second paper feeding rollers, by some reasons or other, the copying paper will be waved between the two rollers. Besides, the rotation of the first and second feeding rollers at the same speed causes the copying paper to make a waving movement, so that the copying paper alternately comes relatively closer to the charging electrode, e.g., a high voltage tungsten wire, and move away from the charging electrode, as it travels from the first paper feed roller to the second paper feeding roller. Accordingly, the copying paper is unevenly charged or sensitized, so that the copied image on the copying paper becomes uneven, which means inferior quality of the copy. The known electrophotographic copying machine has another shortcoming in that, depending on the moisture and other ambient conditions, the sensitized copying paper sometimes stick to the transparent plate as it travels through the exposing portion, and the copying paper is stuck there to hold the movement of the succeeding copying paper.

In order to mitigate such difficulties, it has been proposed to mount fishing gut or other electrically insulating fine thread on the transparent plate, which plate has a suitable light transmittivity and includes two surfaces both being parallel to the travelling copying paper. The fishing gut or the fine thread is wound on the transparent plate in two groups, one group on either side of the central axis of the passage of the copying paper, in such a manner that the distance between the corresponding two turns, one from each of the two groups, increases as they extend in the travelling direction of the copying paper. The fishing gut or the fine thread thus wound acts as a guide for the copying paper. It has been also proposed to form projecting linear ribs or ridges on the paper-facing surface of the transparent plate, in a manner similar to the aforesaid turns of the fishing gut. Such gut, thread, and linear ribs proved to be effective in preventing the electrostatic sticking of the copying paper to the transparent plate. However, the contact of the copying paper with such thread or ribs tends to blur the finished image on the copying paper, especially when the moisture and the temperature in the copying machine are high.

Therefore, an object of the present invention is to obviate such difficulties of conventional copying machines, by providing a window plate of a copying machine which plate consists of a transparent material and has a plurality of recesses disposed in such a manner that the recesses spread out like an unfolded fan, so that actinic light beams carrying an image pass through such recesses.

Thus, according to the present invention, the electrostatic sticking of the copying paper to the transparent plate can be prevented by comb-like non-recessed surface portions, which are formed between adjacent recesses of the aforesaid disposition. Furthermore, the transparent material forming the window plate does not produce any shadows, which may be caused in the case of the conventional fishing gut or ribs, so that the production of a clear copy of original is ensured. Furthermore, with the present invention, no separate elements are added to the transparent plate, and hence, the transparent plate for the exposing portion of electrophotographic copying machine can be manufactured at a low cost.

Other objects and a fuller understanding of the present invention may be had by referring to the following description, taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a schematic perspective view of an exposure window, according to the present invention;

FIG. 2 is a sectional view taken along the line II—II of FIG. 1;

FIG. 3 is a schematic perspective view, illustrating another embodiment of the invention having differently shaped recesses;

FIG. 4 is a sectional view, taken along the line IV—IV of FIG. 3;

FIG. 5 is a schematic sectional side view of an electronic copying machine in which the exposure window of the invention is mounted; and

FIG. 6 is a partial exploded perspective view, showing the portion A of the copying machine of FIG. 5.

Like parts are designated by like numerals and symbols throughout the drawings.

Referring to FIGS. 1 and 2, a window plate 1 according to the present invention consists of a transparent plate made of glass or transparent synthetic resin, such as transparent acrylic resin. At the entry side of the window plate 1, a guide slope 2 is formed, so as to coact with a copying paper bearing plate (not shown). The top surface of the window plate 1, as seen in FIGS. 1 and 2, is faced down to coact with the bearing plate for guiding the copying paper.

A plurality of wells or recesses 3 are formed in the surface of the window plate 1 which faces the copying paper, i.e., the top surface in the figures. In the illustrated embodiment, the recesses are formed at uniform intervals. It is important in the invention that the recesses 3 spread out like an unfolded fan as they extend in the travelling direction of the copying paper. As a rivet of such fan, an equilateral triangular recess 5 is formed at about the central portion of the plate 1 by boring a similarly shaped recess with a suitable depth. The remaining recesses 3 are formed in two groups and disposed in symmetry relative to the central triangular recesses 5. More particularly, each group consists of a plurality of parallelogram recess 3 having longer sides, which are the same with the equilateral sides of the recess 5 in length and disposed in parallel with the latter sides, as shown in FIG. 1. Although two recesses 3 at the extreme ends are shown as triangular, they can be of any suitable shape as long as they form suitable non-recessed portions 4 and provide suitable light transmittivity.

In the embodiment of FIG. 1, the parallelogram recesses 3 and the central recess 5 are disposed along the leading edge of the window plate 1, or adjacent the guide slope 2, it is of course possible to form such triangular and parallelogram recesses 5 and 3 which extend throughout the entire paper-facing surface of the window plate 1, as shown in FIGS. 3 and 4.

Actinic light beams, carrying the image of an original to be copied, pass through the recesses 3 and 5 and are focused on a copying paper (not shown) for producing a copied picture of the original thereon. Such actinic light beams are shown by arrows in FIGS. 2 and 4.

It should be noted here that a plurality of non-recessed surface portions 4 are formed between adjacent recesses 3 and 5. Such non-recessed portions are preferably comparatively narrow, so that the electrostatic or other sticking of the copying paper to the window plate 1 can be effectively prevented.

FIGS. 5 and 6 illustrate an electronic or electrophotographic copying machine incorporating the exposure window 1 of the present invention. In the figures, an original B to be copied is brought on an original holding glass plate 16 by a suitable means (not shown). For feeding a copying paper (not shown) along a path C, a driving roller 6 feeds the copying paper into a charger 7, for the purpose of sensitizing. The copying paper thus sensitized is fed to an exposing portion 10, which consists of a transparent plate 8 and a bearing plate 9. The transparent plate 8 is the aforesaid window plate 1, according to the present invention. The guide slope 2 of the transparent plate 8 and a cooperating guide portion of the bearing plate 9 coact to ensure smooth entry of the copying paper into the exposing portion 10. The details of the portion A of the copying machine, inclusive of the charger 7 and the exposing portion 10, are shown in the exploded perspective view of FIG. 6.

The copying paper thus exposed is then delivered to a developing portion 12 by a feeding roller 11, for development, followed by drying in a drying portion 13. An outlet roller 14 passes the dried copying paper to the outside of the copying machine.

The copying machine of FIG. 5 further includes a feed table 15 for the copying paper, a light-source lamp 17, a lens 18, and mirrors 19 and 20. In FIG. 6, the rollers, inclusive of the driving roller 6 and the feeding roller 11, are actuated by a drive chain 21 through suitable gears. The charger 7 can be mounted on a charger holder 22 integrally formed with a side plate 24 of the copying machine. The bearing plate 9 is replaceably held by the side plate 24 through a spring 32, which urges the bearing plate 9 toward the exposure window 1 with a suitable pressure.

Although the present invention has been described with a certain degree of particularity, it is understood that the present disclosure has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the scope of the invention as hereinafter claimed.

What I claim is:

1. In an electrostatic copying machine, a transparent window plate having front and rear parallel flat faces, a backing plate disposed rearwardly of an confronting said window plate, means for longitudinally advancing a copy sheet between said plates from the trailing edge to the leading edge of said window plate, means for projecting an image through said window plate focused on said window plate rear face, said window plate having formed in the rear face thereof an equilateral triangular well symmetrical to the longitudinal axis of advance of said copy sheet with its apex directed toward said plate trailing edge, and a plurality of parallelogram wells on opposite sides of said triangular well and delineated from each other and from said triangular well by relatively thin partitions integral with said plate, the rear faces of said partitions being coplanar with said plate rear face and the bases of said wells being flat and parallel to said plate rear face and the peripheral faces of said wells being perpendicular to said window plate rear face.

2. The copying machine of claim 1 wherein the trailing face of said window plate is rearwardly sloped from the trailing front edge thereof.

3. The copying machine of claim 1 wherein the opposite faces of said partitions are parallel

4. The copying machine of claim 1 wherein said wells are positioned proximate said window plate trailing edge.

5. The copy machine of claim 4 wherein said wells extend to points proximate said window plate leading edge.

6. An exposure window for an electrostatic copying machine of the type that only a copy paper is introduced into an exposing section between the window plate and a guide plate after being charged, characterized in that said window plate is made of a light permeable substance, and provided with, in its side opposing to said guide plate, a guide slope formed on one edge of the window plate for guiding the entry of a copy

paper into said exposing section, an equilateral triangular recess as a reference at a point corresponding to the center of the copy paper passage, two groups of parallelogram recesses disposed on either side of the reference in such a manner that they spread out as an unfolded fan as they extend in the travelling direction of the copy paper, and ridges defined by each adjacent pair of the recesses, the faces of said window plate, recesses and ridges being flat and parallel with one another.

7. An exposure window according to claim 6, wherein said equilateral triangular and parallelogram recesses are arranged adjacent to and along the guide slope of the exposure window plate.

8. An exposure window according to claim 6, wherein said equilateral triangular and parallelogram recesses extend throughout one surface of the exposure window.

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