

[54] **MULTICOLOR  
ELECTROPHOTOGRAPHIC DEVICE**

[72] Inventor: **Shozo Inoue**, Tokyo, Japan  
[73] Assignee: **Canon Kabushiki Kaisha**, Tokyo, Japan  
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[58] Field of Search.....355/4

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*Primary Examiner*—John M. Horan  
*Attorney*—Ward, McElhannon, Brooks & Fitzpatrick

[57] **ABSTRACT**

An electrophotographic multicolor image reproducing device comprises a rotating type color separation means having a plural number of color separation filter, a means projecting a light image to the color separation filter, a means for fixing a photosensitive member to which a separated color image from the color separation filter is projected, a rotary disc having a plural set of a charging means and a developing means, and a means for synchronizing the change of the color separation filter with the change of the set on the rotary disc and rotating discontinuously the rotary disc and the rotating type color separation means.

**5 Claims, 7 Drawing Figures**

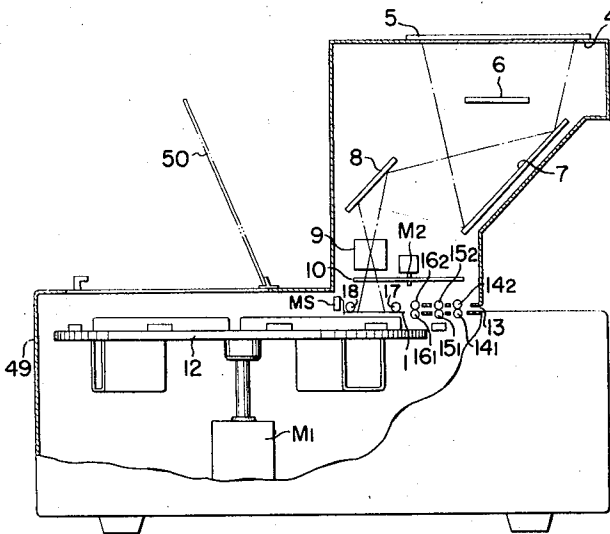


FIG. 1

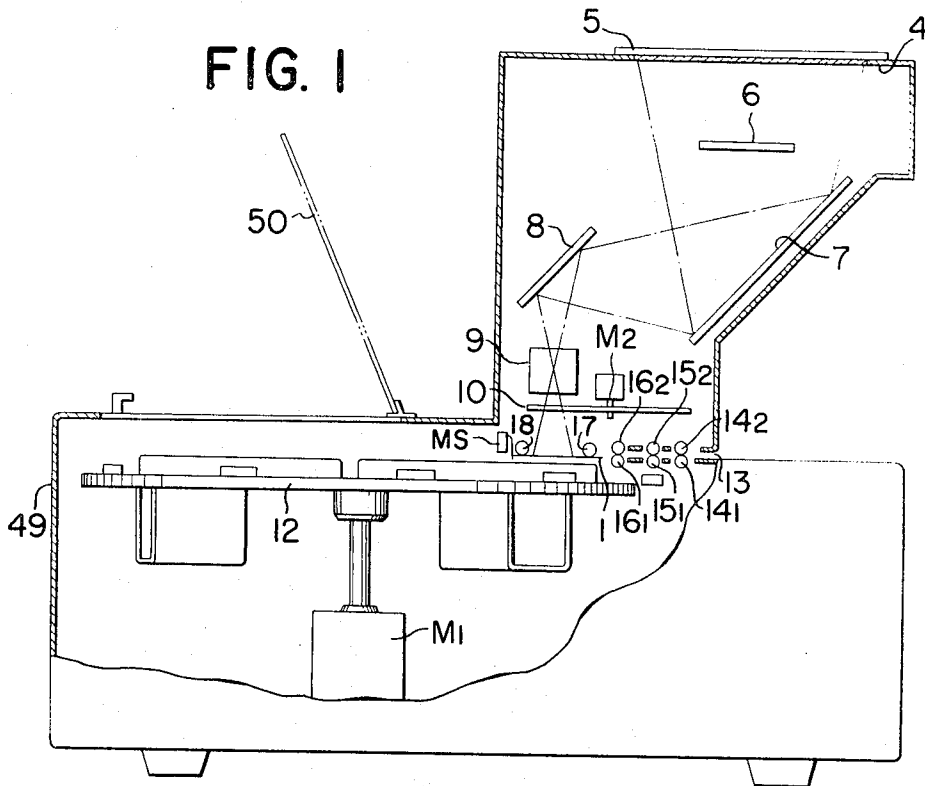


FIG. 2

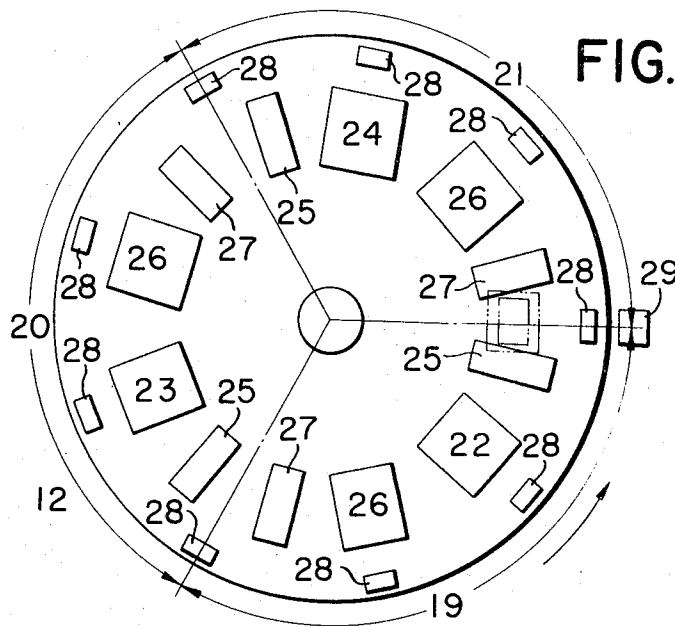


FIG. 3

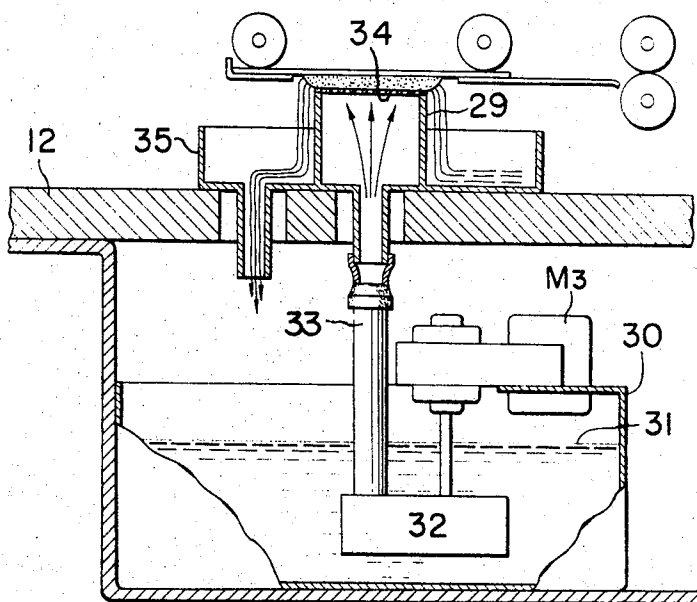


FIG. 4

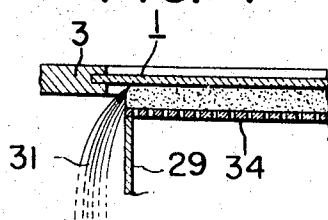


FIG. 5

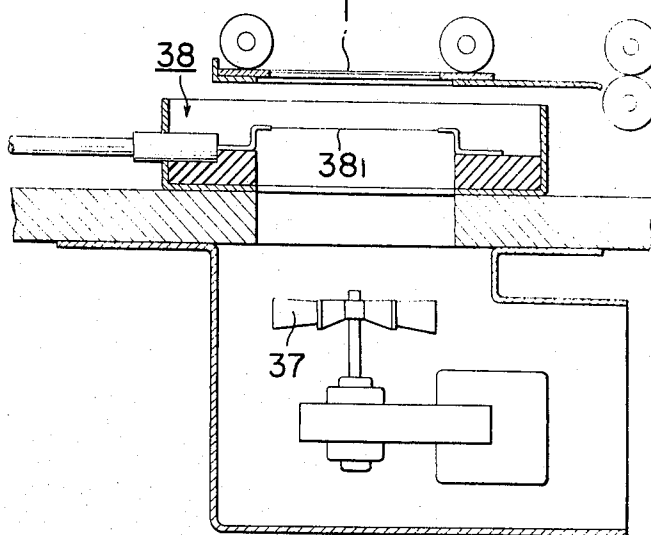


FIG. 6

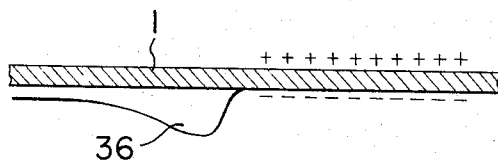
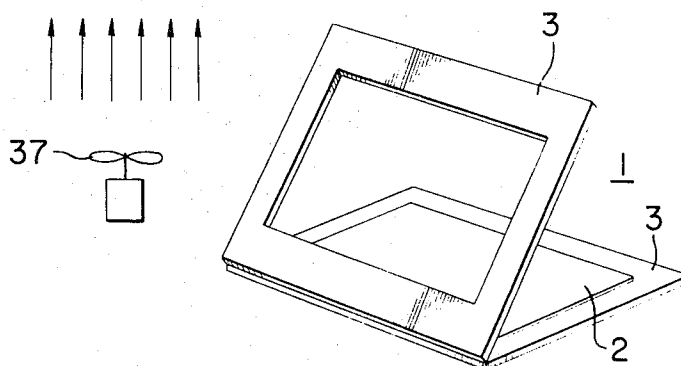


FIG. 7



## MULTICOLOR ELECTROPHOTOGRAPHIC DEVICE

This invention relates to an electrophotographic multicolor image reproducing device, and more particularly to such device in which a photosensitive member is stationary and a rotary disc having various electrophotographic process means mounted thereon is rotated over the stationary photosensitive member to provide a multicolor image reproduction thereon.

One of the problems encountered in carrying out the electrophotographic multicolor printing is the difficulty to achieve the registration or color matching between the separated colors, and this problem has hampered wider practical use of the electrophotographic multicolor image reproducing device. Multicolor image reproducing devices according to the prior art employ a system whereby movement of photosensitive member for each color separation is controlled with high accuracy or a system whereby a photosensitive member is stationary and various electrophotographic process means for each color printing are manually moved. In the former system, it is very hard to achieve registration and a device to solve this problem should be highly accurate in performance and is generally larger in size as well as higher in manufacturing cost. The latter system is very poor in efficiency because of its manual operation and has little or no practicability as a business machine. If the manually operated system is replaced by an automatic system, the device itself must be more and more complicated and sophisticated in construction to satisfy the requirement of registration between the repeated exposure positions and this will unavoidably lead to a higher cost.

The present invention basically falls within the category of the aforementioned latter type or the stationary photosensitive member type and intends to automatize it for wider practical use.

It is an object of the present invention to provide an electrophotographic multicolor image reproducing device which is simple in construction and capable of automatic multicolor printing free from any color mismatching.

According to the present invention, a photosensitive member is used which comprises a layer of photosensitive material supported on a transparent support member and a frame of thick paper or like material having said layer and said support member attached thereto. Such photosensitive member is placed stationarily within the device and an object to be copied placed on a document supporting table is optically projected to the photosensitive member by a source of light through mirrors a lens and color separating filters. The photosensitive member has the photosensitive layer thereof facing downward, and in face-to-face relationship with that downwardly facing photosensitive layer there is disposed a rotary disc provided with various electrophotographic process means. The rotary disc is rotated upon projection of the original image to be copied, so that the photosensitive member may be subjected to the various electrographic processes by the rotation of the rotary disc. The number of the various electrographic process means provided on the rotary disc corresponds to the number of colors required for the multicolor printing. Electrophotographic process means for the colors corresponding to the color separation filters operate in synchronism with each other, and thereby a multicolor image reproduction is carried out.

A preferred form of the invention will now be described with reference to the accompanying drawing wherein:

FIG. 1 is a side view, partially in cross section, of an embodiment of the present invention;

FIG. 2 is a horizontal view of the rotary disc incorporated in the device of FIG. 1 and showing arrangement of various means;

FIG. 3 is a cross-sectional view of the developing means used with the FIG. 1 embodiment;

FIG. 4 is an enlarged fragmentary view showing a part of FIG. 3;

FIG. 5 shows a cross sectional view of the drying means;

FIG. 6 is a view for illustrating a manner in which the residual developing solution on the photosensitive member is

positively removed by contemporaneously effecting the electric charging and drying processes; and

FIG. 7 is a perspective view showing an example of the photosensitive member used in the present invention.

The photosensitive member used in the present invention is generally indicated by 1 in FIG. 7. The photosensitive member 1 comprises a photosensitive material 2 formed of layer of photosensitive material and a transparent support member such as polyester film or the like, and a frame 3 of thick paper or like material available for use as a color slide or apertured card and having said photosensitive material 2 attached thereto. The photosensitive material may be an organic photoconductive material, for example, condensed polycyclic aromatic compounds such as anthracene, carbazole, anthraquinone and perylene, acyl hydrazone derivative, heterocyclic compounds such as triphenyl pyrazoline derivative and the like, or organic materials such as poly-N-vinyl carbazole and the like. However, the material forming the photosensitive layer and the material forming the photosensitive member are not limited to the abovementioned materials.

Now referring to FIG. 1, a photosensitive member 1 is fixed within the device and an image of an object 5 to be copied placed on a document supporting table 4 is, projected to photosensitive member 1 by a light source 6 through mirrors 7 and 8, a lens 9 and a color separation filter 10. The photosensitive member 1 has the photosensitive layer facing downward, and in face-to-face relationship with the downwardly facing photosensitive layer there is disposed a rotary disc 12 provided with various electrophotographic process means and driven to rotate by a motor M1.

The photosensitive member 1 is fed into the device through an inlet 13 and then carried to a developing means through feed rolls 14, 14<sub>2</sub> to 18. When the photosensitive member 1 reaches a predetermined position, a setting switch MS is actuated to stop the rotation of feed rolls. A swinging door 50 is provided to a housing 49 for the purpose of maintenance and check-up of the electrophotographic processing means.

Referring to FIG. 2, rotary disc 2 comprises first to third process means 19 to 21, which are respectively provided with different color developing means 22 to 24. Natural color printing by electrography usually needs three processes, but if four or more processes are required, the number of the process means used is increased accordingly.

Each of the process means 19 to 21 is further provided with electrically charging means 25, cleaning means 26 and drying means 27 which are all provided on the rotary disc 12. Control signal members 28 peripherally provided on the rotary disc 12 cooperate with a detector means 29 provided outside of the rotary disc 12 so as to control the motor M1 to rotate the rotary disc 12 intermittently in a predetermined direction. Such intermittent rotations of the rotary disc 12 bring the process means 19 to 21 into their operative position in succession, and in synchronism therewith the color separation filter 10 (FIG. 1) is changed through a motor M2. Thus, the photosensitive member 1 is exposed to different separated color lights in succession.

When the photosensitive member is placed at a position shown by the dotted lines in FIG. 2, the rotary disc 12 is rotated to the direction of the arrow while it is electrically charged by the electrically charging means 25. When the rotating disc 12 brings the developing means 22 thereon into registered relationship with the photosensitive member 1, rotary disc 12 is stopped by a signal from control member 28 and detector means 29 at that position, and an image to be copied is projected through a color separation filter 10 to the photosensitive member 1 to form electrostatic latent images. Referring to FIG. 3, the pump 32 is driven by motor M3 in FIG. 3 responding to an exposure termination signal, and thereby developer liquid 31 in reservoir 30 is fed to developing cylinder 29. The developer liquid overflows through a perforated 34 having small holes mounted to the top opening of developing cylinder 29 which is positioned in such a manner that the overflow coincides with the image portion of

photosensitive member 1 in frame 3 (FIG. 4). Thus, developing is carried out. The developer liquid overflowing the developing cylinder 29 is recovered to receiver 35. After a predetermined period of time, pump 32 is stopped by a developing termination signal, and rotary disc 12 is rotated until a cleaning 26 comes into contact with photosensitive member 1. Another example of the developing means is that a rotatable developing roller impregnating a developer liquid comes into contact with the photosensitive member.

The cleaning means 26 is provided, if necessary, which may be a similar structure to that of the developing means except that a cleaning liquid is used in place of developer liquid. The remaining developer liquid is removed which causes fog at the developed portion.

The drying means 27 is provided, if necessary. Referring to FIG. 5, wind or hot wind is blown to photosensitive member 1 by fan 37 to dry the photosensitive member 1. When the blowing is carried out simultaneously with charging by rotating charging means 38 having discharging wire 38<sub>1</sub>, cleaning liquid 36 on the photosensitive member is pushed to a direction opposite to a direction to which the charging means moves as illustrated in FIG. 6 and thereby the drying capacity increases.

According to an embodiment of the exposure means illustrated in FIG. 1, the exposure is effected to photosensitive member 1 from above. However, another example of exposure means is that an exposure opening is provided at a region between charging means 25 and developing means 22 (23 or 24) on rotary disc 12 in FIG. 2 and the exposure may be made from the lower side of rotary disc 12.

In view of the foregoing, it will be appreciated that the electrophotographic device according to the present invention employs a stationary photosensitive member and exposure means and a rotary disc provided with various electrophotographic process means which is intermittently rotatable to effect the various electrophotographic processes in succession, whereby the exposure of the photosensitive member to separated colors may be repeated without any care being taken of the registration between the resultant color images. Further, the rotary system adopted for the process means only

requires a simple driving mechanism to achieve a high performance and this leads to the provision of a highly practical and inexpensive device for the electrophotographic multicolor image reproduction.

What is claimed is:

1. An electrophotographic multicolor image reproducing device which comprises means for charging a photosensitive member uniformly, means provided with a plurality of different color separation filters for positioning one of said filters selectively at an exposure position, means for projecting an original image to the photosensitive member through a positioned color separation filter, means for developing an image formed on the photosensitive member only on one side thereof, means provided with developing means of the same number as that of the kinds of color separation filter for positioning one of the developing means selectively corresponding to the kind of the filter, through which the original image has been projected, at a developing position, and means for fixing said photosensitive member at a predetermined position until process of color reproduction is completed.

2. An electrophotographic multicolor image reproducing device according to claim 1, wherein said projecting means and said developing means are disposed oppositely with respect to said photosensitive member.

3. An electrophotographic multicolor image reproducing device according to claim 1, wherein said positioning means of the developing means is provided with as many charging means as the developing means.

4. An electrophotographic multicolor image reproducing device according to claim 3, wherein said positioning means of the developing means is provided with as many means for cleaning residual developer as the developing means.

5. An electrophotographic multicolor image reproducing device according to claim 4, wherein said positioning means of the developing means is provided with as many drying means as the developing means.

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