

March 4, 1969

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3,431,050

COMBINATION PAPER AND DEVELOPER SUPPLY

Filed Jan. 4, 1967

Sheet 1 of 2

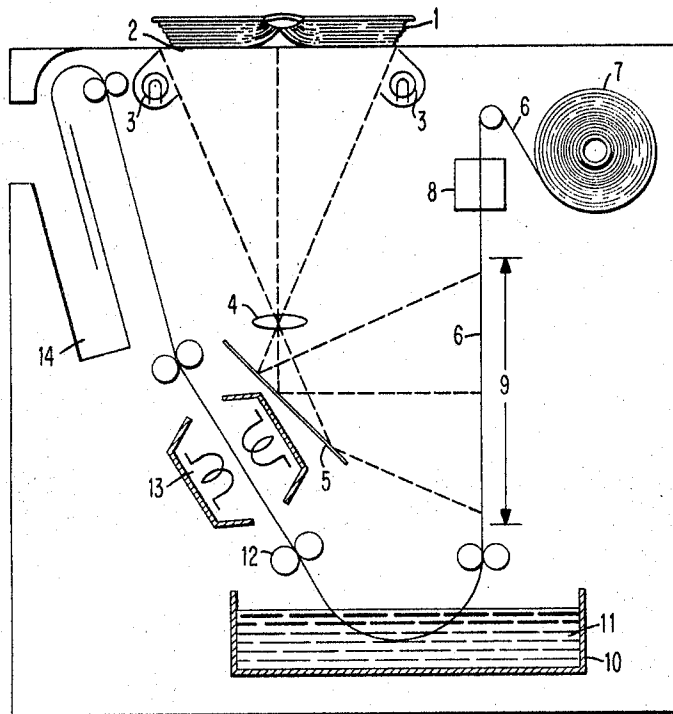


FIG. 1

PRIOR ART

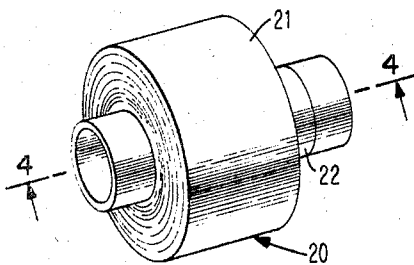


FIG. 2

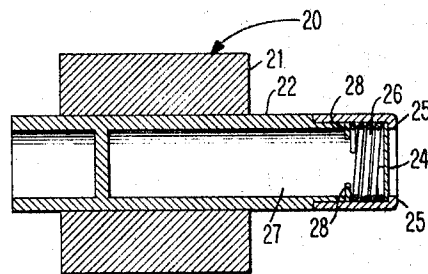


FIG. 4a

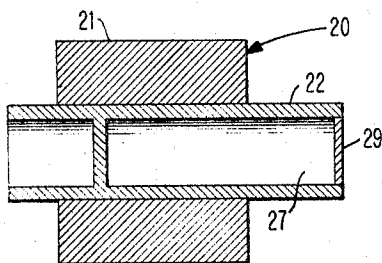


FIG. 4b

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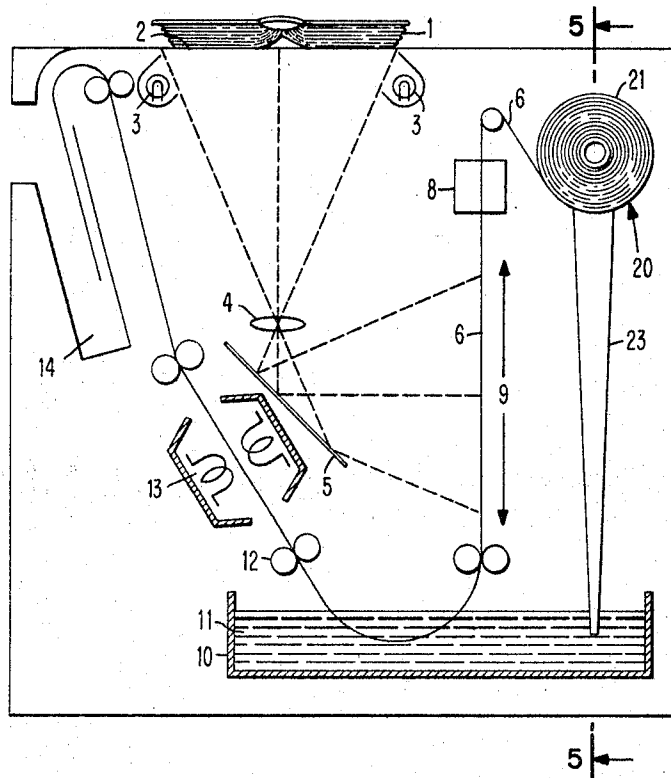


FIG. 3

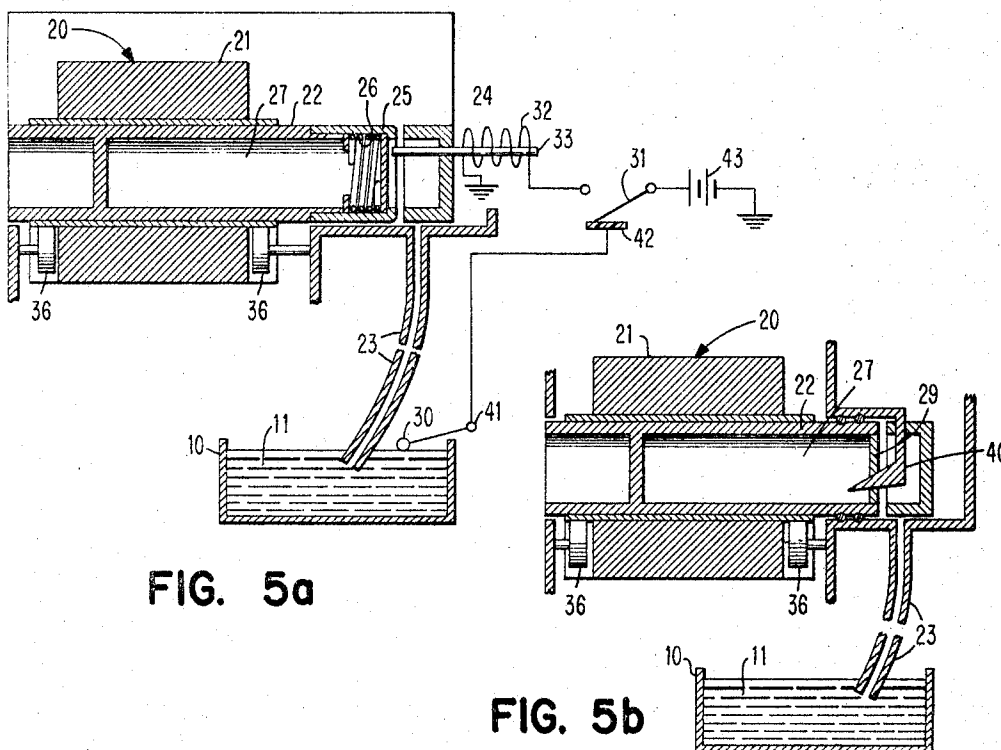


FIG. 5a

FIG. 5b

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COMBINATION PAPER AND DEVELOPER SUPPLY
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Filed Jan. 4, 1967, Ser. No. 607,174

U.S. Cl. 355—10

Int. Cl. G03g 15/10

9 Claims

ABSTRACT OF THE DISCLOSURE

A single package containing both paper and developer. The paper is wound about a core within which is sufficient developer to be used with the amount of paper wound about the core. When the package is placed in a copying machine, the developer will automatically be fed to a reservoir from which it may be accessed.

Summary of the Invention

This invention relates to electrostatic printing and more particularly to a combination package for paper and developer to be used in an electrostatic printing machine.

In the art of electrostatic copying, electrostatic images are produced on the surface of an insulating material. Such images comprise a pattern of electrostatic charges on the surface. Visible images are then produced from the charge patterns by applying across the surface of the insulating material a developer or toner. The developer may be either a liquid or a fine powder. The latent electrostatic images are either formed and developed directly on photosensitive paper or formed and developed on an intermediate photosensitive member and then transferred to plain paper to provide the output copy. In prior art machines, replenishment of developer and of paper involves two separate and distinct operations. Not only are two separate operations involved, but they are usually necessary at different times. This is because the quantity of developer within the machine is normally not related to the paper capacity and therefore exhaustion of developer and of paper will normally occur at different times. Another disadvantage of the prior art is the inherent messiness involved in frequent changes of developer. A further disadvantage of the prior art is variations in toning on the copy caused by fluctuations in the density of marking particles in the suspension as the level of toner in the reservoir within the machine is depleted.

It is therefore an object of this invention to replenish both paper and toner supplies in a single operation.

In accordance with the above object, this invention provides a single package containing both paper and developer. In accordance with one aspect of the invention insertion of the package into an electrostatic copying machine will cause the developer to be dumped into a reservoir where it will be accessible during the copying process. In accordance with another aspect of the invention, as developer in a reservoir is used, more developer will be metered out from the package and into the reservoir. Thus, the paper and the developer contained within the combination package will be exhausted at substantially the same time.

One advantage of the invention is that developer and paper are both replenished in a single operation. A further advantage of the invention is that the operator of the machine does not come into direct contact with the developer and is therefore less likely to be soiled by it. A feature of the invention is that the concentration of developer within the reservoir in the electrostatic copying machine will be kept within close limits. This leads to

the further advantage of reducing variations in toning and improving overall performance of the machine.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of preferred embodiments of the invention, as illustrated in the accompanying drawings.

Brief description of the drawings

FIGURE 1 is a schematic drawing of a prior art electrostatic copying machine.

FIGURE 2 is a side view of the combination package.

FIGURE 3 shows the combination package in place in an electrostatic copying machine.

FIGURE 4a is a cross-sectional view of one embodiment of the invention taken along the line 4—4 of FIGURE 2.

FIGURE 4b is a cross-sectional view of another embodiment of the invention taken along the line 4—4 of FIGURE 2.

FIGURE 5a is a cross-sectional view taken along the line 5—5 of FIGURE 3 and shows the first embodiment of the invention in place in an electrostatic copying machine.

FIGURE 5b is a cross-sectional view taken along the line 5—5 of FIGURE 3 showing the second embodiment of the invention in place in an electrostatic copying machine.

Description of the preferred embodiment

As used herein, the generic term "developer" includes chemicals which react with the coating on a paper to form an image, toning particles mixed with a carrier (commonly called "toners") which can form an image on paper, and any other liquid or powder which can be used to produce an image on specially treated or untreated paper.

Referring to FIGURE 1, the essential elements of a typical electrostatic copying machine are shown. A document 1 which is to be copied fits atop a glass plate 2. Light is directed onto the document by light sources 3. Light reflected from the document is collected by a lens 4 and focused upon an image plane 9 after reflection from a mirror 5. Photosensitive paper 6 is fed from a supply roll 7 through a corona charging unit 8 to the exposure plane 9. The light from the document 1 which has been directed upon the face of the mirror 5 will then be reflected onto the paper 6 which has been transported to and is maintained stationary at the exposure plane 9. The light reflected from the document 1 will substantially reduce or eliminate the charges placed on the paper by the corona unit 8 at those areas corresponding to blank or non-image areas on the document. The areas representing the image on document 1 will not reflect light and thus charges corresponding to these areas will be retained on the photosensitive paper 6. The paper 6, now containing a latent or undeveloped image, will then pass through a reservoir 10 containing developer 11. This will produce on the paper, in those areas which were not struck by light, a visible image of the toner material. The paper then passes between pressure rollers 12 to remove excess developer. The visible image will be fixed to the paper as it passes a heat lamp 13. The paper will then be transported by transporting means (not shown) to a receptacle 14 from which the finished copy may be removed.

Referring to FIGURE 2, there is shown an improved package 20 comprising photosensitive paper 21 wound about a central core 22. The core 22 has a hollow portion containing within it sufficient developer to process substantially all of the paper that is wound about the core. For reasons which will be explained below, the amount of developer within the hollow portion of the core 22 will preferably have a negative tolerance; that is,

there will be sufficient developer to process no more than the amount of paper 21 wound about the core. For example, if there is sufficient paper to make 1000 copies, an amount of developer will preferably be supplied that is sufficient to make on the order of 975-1000 copies, but not more than 1000 copies. Thus, the central core 22 performs the dual function of holding developer within it and of supporting the paper that is wound about it.

Referring to FIGURE 4, further details of two preferred embodiments of the novel package are shown. In the embodiment shown in FIGURE 4a, the hollow portion 27 of the core 22 is sealed by a movable cover 24. The cover 24 is held against abutment 25 by one end of a spring 26. The other end of the spring presses against abutment 28 within the hollow portion of the core. The diameter of the movable cover 24 is slightly less than the inner diameter of the core 22 so that, when the cover 24 is moved away from abutment 25 against the pressure of spring 26, developer contained within the hollow portion 27 of the core will flow out from the core.

In FIGURE 4b, there is shown another embodiment of the combination package. In this embodiment, the hollow portion 27 of the core 22 is sealed by a rupturable membrane 29. The membrane 29 may be made of plastic, rubber or any other suitable material which may be punctured by a knife or other sharp object.

Operation of the invention

FIGURE 3 shows the combination package 21 for paper and developer in place in an electrostatic copying machine. The chute 23 serves to carry developer from the package 21 to the reservoir 10.

Referring to FIGURE 5a, the operation within an electrostatic copying machine of the embodiment of this invention shown in FIGURE 4a will now be more particularly described. Prior to insertion of the package 20 into the machine, the reservoir 10 will have been supplied with an initial amount of developer 11. In order to provide means for metering developer out from the hollow core 27 of the combination package 20, metering means comprising a float 30, a switch 31, a solenoid 32, a plunger 33, a pivot 41 and an insulating pad 42 are provided. The pad 42 may be made of nylon or other suitable insulating material. As the developer 11 in the reservoir 10 is used, the float 30 will descend into the reservoir (thereby causing the insulating pad 42 to rise) until it reaches a sufficient depth to cause the switch 31 to close. The closure of switch 31 will cause electrical means 43 to energize the solenoid 32 to cause the plunger 33 to push forward on the cover 24 of the package 20 against the force of the spring 26. This will allow developer to flow out from the hollow portion 27 of the core 22 past the cover 24, and down through the chute 23 to the reservoir 10. As the reservoir 10 is filled with developer to the proper level, the float 30 will rise and cause the switch 31 to open. This will de-energize the solenoid 32 and allow the pressure of the spring 26 to reseal the cover 24 of the hollow core against the abutment 25. Then, as more developer is used, the float 30 will again descend into the reservoir 10 until the switch 31 is again closed. This will cause more developer to be released into the reservoir and a proper level of developer will be maintained. Since the amount of developer contained within the hollow portion 27 of the core 22 is sufficient to process no more than the amount of paper wound about said core, after the supply of paper 21 has been exhausted there will be no more developer contained within the core. Since there will generally be slightly less developer within the hollow portion 27 of the core 22 than is needed to process all of the paper 21 wound about the core, the developer 11 which was initially supplied to the reservoir 10 will gradually be diminished. However, this will cause no inconvenience to the operator of the machine because the initial supply of developer will be used up so gradually that it need not be replenished between the times that the machine has its normal periodic service. At these times, the service man

will check the level of developer 11 within the reservoir 10 and replenish it to the extent that is necessary. It will be recognized by those skilled in the art that this invention is not limited to the specific arrangement shown to actuate the solenoid. Any float actuated switch could equally well be used.

Referring to FIGURE 5b, the operation of the embodiment of the invention shown in FIGURE 4b will be described. Means to rotate the package 20 so that paper 21 may be unwound therefrom is not shown in detail but is represented by the frictionally engaged rotatable wheels 36. Fixed to the frame of the machine is a knife edge or other cutting means 40. When the package 20 is inserted into the copying machine, the cutting means 40 will puncture the membrane 29 which seals the hollow portion 27 of the core 22. This will allow substantially all of the developer within the hollow portion of the core to flow out from the core and down the chute 23 into the reservoir 10 from which it may be accessed during the copying process. For the reasons described above, the reservoir 10 will be initially supplied with an amount of developer 11 that is sufficient to make up for the cumulative negative tolerances of the developer contained within the combination packages 20 that will be used between the times that the machine is normally serviced. When the machine is serviced, the service man will add sufficient developer to the reservoir 10 to make up for the decrease in the amount of developer originally supplied. Thus, the operator of the machine need not be concerned with the amount of developer in the reservoir 10.

It will, of course, be recognized by those skilled in the art that various changes could be made to the invention as described above without departing from the spirit and scope thereof. For example, the combination package could be constructed in such manner that the developer is stored within a container that is slideable within the core around which the paper is wound. Then, when the package is inserted into a copying machine, the developer contained will be moved into contact with a knife edge, solenoid controlled plunger, or other means to release the developer from its container.

It will also be understood that this invention is not limited to machines using an expendable photoconductor such as photosensitive paper. For example, xerographic machines using plain paper for output copies could equally well utilize the combination package of this invention. The only difference would be that developer is transferred from a photosensitive element, such as a rotating drum, to the paper.

Should it be desired to use powdered developers, they can be dispensed from the combination package by gravity, pressure or other suitable means to effect the same results described above.

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. In a copying machine, a combination package for paper and developer comprising:
 - a hollow cylindrical core;
 - a supply of paper wound about said core;
 - a supply of developer carried within said core, said supply of developer being sufficient to develop latent images necessary to utilize substantially all of said paper wound about said core; and
 - means to release said developer from said core so that said developer may be used for copying;
- said combination package obviating any need to separately replenish paper and developer supplies.
2. The combination package for paper and developer of claim 1 wherein:
 - said developer is held within said hollow cylindrical core by a rupturable membrane; and

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said means to release said developer comprises cutting means to rupture said rupturable membrane.

3. The combination package for paper and developer of claim 1 wherein:

said hollow cylindrical core has a movable cover yieldingly biased to a closed position to normally prevent said developer from moving from within said core.

4. The combination package for paper and developer of claim 1 wherein:

said paper is sensitive to light for the formation of images directly thereon.

5. In a copying machine, the combination comprising:

a hollow cylindrical core;

a supply of paper wound about said core;

a supply of developer carried within said core, said

supply of developer being sufficient to process sub-

stantially all of said paper wound about said core; said hollow cylindrical core having a cover normally preventing said developer from moving from within said core;

opening means to open said cover when said core having said paper wound thereon is mounted in said copying machine; and

switch means actuating said opening means when more developer is needed by said copying machine;

said developer thus being metered out from said hollow cylindrical core as it is needed.

6. The combination of claim 5 wherein:

said paper is sensitive to light for the formation of images directly thereon.

7. The combination of claim 5 wherein: said developer consists of a liquid.

8. The combination of claim 5 wherein:

said cover is yieldingly biased to a closed position to normally prevent said developer from moving from within said core;

said opening means comprises

a solenoid, and

a plunger responsive to actuation of said solenoid to move said cover to an open position per-

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mitting said developer to move out from said hollow cylindrical core; and

said switch means comprises a float operated switch responsive to a need by said copying machine for additional developer to actuate said solenoid.

9. In an electrostatic copying machine, the combination comprising:

a hollow cylindrical core;

a supply of photosensitive paper wound about said core;

a supply of toner carried within said core, said supply of toner being sufficient to process substantially all of said photosensitive paper wound about said core;

said core having a movable cover yieldingly biased to a closed position normally preventing said toner from moving from within said core;

a solenoid;

a plunger responsive to actuation of said solenoid to move said movable cover to an open position permitting said toner to move out from said core;

reservoir means holding toner that has moved out from said core;

chute means guiding said toner that has moved out from said core to said reservoir means; and

float operated switch means responsive to a lowering of the level of toner in said reservoir means to actuate said solenoid when more toner is needed in said reservoir means;

said toner thus being metered out from within said hollow cylindrical core as it is needed.

References Cited

UNITED STATES PATENTS

3,195,430 7/1965 Young.

3,233,781 2/1966 Grubbs.

NORTON ANSHER, *Primary Examiner*.

L. H. MCCORMICK, JR., *Assistant Examiner*.

U.S. Cl. X.R.

222—57; 118—637

Disclaimer

3,431,050.—*Charles S. Jenkins*, Lexington, Ky. COMBINATION PAPER AND DEVELOPER SUPPLY. Patent dated Mar. 4, 1969. Disclaimer filed Apr. 23, 1971, by the assignee, *International Business Machines Corporation*.

Hereby enters this disclaimer to claims 1, 3 and 4 of said patent.
[*Official Gazette October 26, 1971.*]