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(54) **Method for forming toner images with two distinct toners**

Verfahren um Tonerbilder aus zwei unterschiedlichen Tonermaterialien zu erstellen

Procédé de formation d'images de toner utilisant deux matériaux de toner distincts

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(56) References cited:
EP-A- 0 625 731 EP-A- 0 667 564
US-A- 4 205 322 US-A- 5 241 356

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Description

[0001] This invention relates to the formation of toner images and, more specifically, to the formation of toner images of two distinct toners, for example, toners of two different colors.

[0002] U.S. Patent No. 5,001,028 to Mosehauer et al, issued March 19, 1991, is representative of a large number of patents which show the creation of multicolor toner images by creating two unfixed images on a single frame of a photoconductive image member. Color printers have been marketed using this general approach, using discharged area development (DAD) and electronic exposure for each image.

[0003] In the Mosehauer patent, the second and subsequent images are toned with a particular toning process using high coercivity carrier and a rotating magnetic core. This process provides a very soft magnetic brush which disturbs the earlier toner images less than an ordinary magnetic brush, even though the brush strands may be allowed to contact the image member.

[0004] "Scavenging" of first image toner into the second station is a well documented problem, especially of repetitive DAD toning steps (DAD-DAD imaging). Many prior references suggest projection toning for applying toner to second and subsequent images in DAD-DAD processes. This reduces "scavenging" of the first image into the second toning station, but it also reduces the speed at which the second image can be toned to reasonably full density. U.S. Patent No. 5,409,791 to Kaukeinen et al, issued April 25, 1995, demonstrates that the use of a toning process similar to that used in the Mosehauer reference but with the brush strands separated from the image member can maintain both the reduced scavenging of projection toning while still toning at high speed (albeit not as high as contact toning as shown in Mosehauer).

[0005] Although projection toning reduces scavenging to tolerable limits and the use of the Kaukeinen invention provides improved density at high speed compared to prior projection systems, performance of projection toning is heavily dependent upon accurate spacing between a toning applicator and the image member. Such spacing has been found to be quite difficult to maintain in practice and, in fact, is accomplishable only by putting more complexity and expense into the components themselves.

[0006] US-A-4,205,322 discloses an electrostatic recording apparatus in which a toner image consisting of toner particles of at least two different kinds and of different polarities is efficiently and reliably transferred to a recording medium. The latent images on a carrier created by the two photoconductive layers at the two exposure positions in Fig. 5, are developed simultaneously with two toners of two opposite polarities.

[0007] EP-A-0625731 describes a problem with a DAD-DAD system in which toner on the edges of areas of the first image, which abut second images, have a

tendency to move into the second image as a result of the second exposure. Overlapping of the first image with the second image corrects this problem in this process. The image overlapping is facilitated by exposing the second image through the base.

[0008] A few references suggest a mixture of discharged area development and charged area development (DAD and CAD). For example, see U.S. Patent No. 5,045,893 to Tabb, granted September 3, 1991, in which the first toner image is made using DAD, the image member is recharged and re-exposed with the second image made using CAD. See also in this respect, U.S. Patent Nos. 5,208,636; 5,241,356; 5,049,949; and 5,258,820.

SUMMARY OF THE INVENTION

[0009] It is an object of the invention to improve on such prior multi-image systems.

[0010] This and other objects are accomplished by a method in which an image member is charged to a first polarity and exposed to create an electrostatic image. The electrostatic image is developed with toner also charged to the first polarity (DAD). The image member is preferably not recharged, but is exposed to create a second electrostatic image, still of the first polarity. This image is toned with a toner of a second polarity opposite the first polarity (CAD). Preferably, the second toning step uses contact development with a magnetic brush of the Mosehauer type. That is, it has "hard" magnetic carrier and a rapidly rotating magnetic core with the developer moving into direct contact with the image member during the development process. Because of the contact development, applicator to image member spacing is no longer critical, and image density at high speed is improved. Scavenging is far less than with a DAD-DAD process because the development field in the second station is maintained at a level that rejects toner of the first polarity. Also, because of the fields, there is very little "overtoneing" of the first image by the second station.

[0011] In experimenting with this process, we found that line images had a tendency to lose their resolution. After some analysis, we concluded that this was due to movement of toner in response to the second exposure step, somewhat similar to the movement of toner in a DAD-DAD process toward which the prior Guth et al patent application was directed (EP-A-0625731, cited above). We have demonstrated that this problem is corrected when the second exposure is accomplished from the side of the image member opposite that containing the first toner image. This allows us to discharge the image member under the first image to a level below that of the untuned portions of both images. Note that this is not a case of overlapping toner images, as was done in the Guth application, since the image portion of the second image may be quite separated from the first toner image. It is a solution based on assuring thorough dis-

charge of the area under the first toner image in the second exposure.

[0012] Thus, according to a preferred embodiment, high resolution two color toner images are produced with little scavenging using a DAD-CAD process with contact developing of the second image with a brush having "hard" magnetic carrier and a rotating magnetic core and with a second exposure through the side of the image member opposite the first toner image.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

FIGS. 1-7 show seven steps in a method for forming a two color image.

FIGS. 8-14 show a submethod variation on the method shown in FIGS. 1-7.

FIGS. 15-18 show a four step submethod which is a variation to the submethod shown in FIGS. 8-14.

FIG. 19 is a side schematic of an image forming apparatus.

FIG. 20 is a side schematic of a development station.

DETAILED DESCRIPTION OF THE INVENTION

[0014] FIGS. 1-7 illustrate a DAD-CAD method (sometimes herein called a "submethod") of forming a two color toner image. According to FIG. 1, an image member 1 includes an image side 2 and an opposite or base side 4. Preferably, the image member 1 is transparent. For example, it can be a belt or web image member having a polyester or other suitable transparent support well known and used in the art. Such image members include a transparent conductive layer on the image side 2 upon which is coated suitable photoconductive layers to make the image member 1 photoconductive. The conductive layer and photoconductive layers are extremely thin and are not shown in the FIGS. The image member could also be a glass drum with similar layers coated thereon.

[0015] The method will be described with respect to a negative charging image member. It will be clear to those skilled in the art that a positive charging image member could also be used.

[0016] The image member is uniformly charged to a negative potential. It is imagewise exposed to create a negative electrostatic image and, as shown in FIG. 1, a negative toner is applied to it in the presence of an electric field which encourages deposition of the negative toner according to the amount of discharge of the electrostatic image. That is, the toner shown in FIG. 1 ad-

heres to areas of lowest potential in the electrostatic image, creating a first toner image, as shown in FIG. 2, created by a DAD process.

[0017] According to FIG. 3, the image member is exposed through its base 4 (preferably without recharging) to create a second electrostatic image. It is important that this exposure be conducted through the base in order to discharge the charge underneath the first toner image below that of exposed areas surrounding the first toner image. If this charge is not dissipated, the negatively charged first toner has a tendency to be pushed by that charge into the areas adjacent it that have been equally or more discharged, thereby reducing the sharpness and resolution of the first toner image. With exposure through the base, we have been able to reduce the charge underneath the first toner image to 50-100 volts below that of areas surrounding the image that are also exposed. This allows the adjacent negative charge to hold the negative toner of the first image in place.

[0018] According to FIG. 4, the second electrostatic image is toned using a CAD toning process. More specifically, a magnetic brush 11 containing positive toner applies toner to image member 1 in the presence of an electric field that encourages deposition of toner on the high potential portions of the second electrostatic image. Typically, in CAD development, the electric field is biased so that magnetic brush 11 is slightly more negative than the exposed portion of the second electrostatic image to inhibit development of the nonimage areas in the second electrostatic image. This bias also inhibits pickup of negative toner from the first image.

[0019] The two color toner image, shown in FIG. 4, contains both negatively charged and positively charged toner. For electrostatic transfer, the image is treated so that it responds more uniformly in an electrical field. According to FIG. 5, this is accomplished by using a negatively biased corona charger 15 which sprays negative charges on the image side of the image member 1. As is well known in the art, the charger 15 can be assisted by an erase lamp 17 which, with a transparent image member 1, can be positioned on the opposite or base side of the image member 1. As shown in FIGS. 6 and 7, the two color image is transferred to a receiving sheet 30 in the presence of an electric field created by a bias supplied from a source of potential 19 to a transfer backing member or roller 23. The receiving sheet 30 is separated from the image member 1, as shown in FIG. 7, with the two color image attached.

[0020] The use of CAD developing with opposite polarity toner for the second image greatly reduces the tendency of first toner to scavenge into the second station or for the second toner to overtone the first toner image. This permits the use of contact developing rather than projection developing with its increased density at high speed and greatly reduced sensitivity to spacing.

[0021] The reduced scavenging effect is optimized by the use of a brush similar to that shown in the Mosehauer patent. This brush will be discussed in more detail

with respect to FIG. 20. It has a very soft nap which reduces the tendency of the brush to scrape off the first image and also provides extremely high density development at high speed with a relatively small development station.

[0022] Early resolution problems we encountered were caused by movement of toner in the first image in response to the second exposure step. This movement is due to residual charge of a negative polarity underneath the first toner which pushes the particles into the background of the second image which has less remaining charge after the second exposure. This problem has been virtually eliminated by exposing the second image through the base, as shown in FIG. 3 and as explained above.

[0023] Any toner from the first image that has a tendency to be scavenged into the second toning station is likely to be deposited in the background of subsequent images, assuming it has maintained its original charge. The life of the developer in the second station is dependent upon the extent of this scavenging. The point at which a noticeable amount of the first, negative toner from the first image appears in the background of the second image is the point at which the developer must be changed in the second station. Because of the polarities of the toners in the DAD-CAD process, shown in FIGS. 1-7, and the softness of the development brush, shown in FIG. 20, this effect is quite small, and the life of the developer is relatively long. However, we have found two submethods which can prolong the life of the second developer even further.

[0024] The first submethod is illustrated in FIGS. 8-14. These FIGS. show a method in which there is a demand for second color only images. That is, if the color of the first toner image is black and the color of the second toner image is red in the process shown in FIGS. 1-7, the same apparatus will, from time to time, be asked to make only red images for one or more runs. Image member 1 is shown in FIG. 8 without any charge on it as it enters the process. According to FIG. 9, it is charged to a negative polarity by the same charging device 9 used to form the first electrostatic image in FIG. 1. According to FIG. 10, the image member 1 is image-wise exposed to create a negative electrostatic image, and according to FIG. 11, that electrostatic image is toned by application of positive toner from magnetic brush 11.

[0025] Magnetic brush 11 has been operating for many images without changing the developer and contains some negatively charged toner that had been scavenged from first, black images in earlier two-color image forming runs. Some of these negatively charged black toner particles have a tendency to deposit in the background portions of the electrostatic image, as shown in FIG. 11.

[0026] However, for the submethod shown in FIGS. 8-14 where only red images are desired, the treatment step shown in FIG. 5 is eliminated and the red image

with some black toner particles in its background is fed into the transfer station, as shown in FIG. 12. However, the transfer field is reversed in FIG. 12 from that shown in FIG. 6 to encourage the transfer of untreated positively charged (red) toner particles while inhibiting the transfer of negatively charged (black) toner particles. Thus, as shown in FIG. 13, the receiving sheet 30 is separated from image member 1 with the red toner image adhering to receiving sheet 30 and the black toner adhering to image member 1. As shown in FIG. 14, the black toner is cleaned off image member 1 by a cleaning device 29 at a cleaning station so that the image member 1 can be reused.

[0027] The submethod shown in FIGS. 8-14 provides background-free copy with an old developer while actually getting rid of some of the contamination of magnetic brush 11. An extended single color run of this nature would have a cleansing effect on the second development station, thereby prolonging the life of its developer.

[0028] FIGS. 15-18 illustrate use of a similar submethod to that shown in FIGS. 8-14 to clean the second development station without actually making images. According to FIG. 15, the image member is discharged by some means, for example, the same exposure means that forms the electrostatic image in FIGS. 3 and 10. According to FIG. 16, the magnetic brush 11 is allowed to attempt to tone the discharged image member 1 in the presence of a field urging the application of negative toner to image member 1 while discouraging the application of any positive toner. This field is shown in FIG. 16 as having a somewhat stronger negative bias on toning station 11 than is used for development (FIGS. 4 and 11). The treating step shown in FIG. 5 can be again eliminated. The transfer step, shown in FIG. 6, is also eliminated. No receiving sheet need be fed. As shown in FIG. 17, transfer backing member 23 is articulated away from image member 1. Transfer to the backing member 23 can also be prevented by adjusting the bias on transfer backing member 23 as is done in FIG. 12. If electrostatic transfer is accomplished by a corona, the corona need only be turned off. The negative (black) toner on image member 1 is then cleaned off by cleaning device 29, as shown in FIG. 18.

[0029] The submethod shown in FIGS. 15-18 can be employed any time the apparatus is otherwise not in use, for example, it can be routinely used while the apparatus is warming up, since the routine does not require use of a fuser which may require the longest warm-up time.

[0030] FIG. 19 shows an image forming apparatus 10 for carrying out all three submethods shown in FIGS. 1-18. According to FIG. 19, an image member 1 in the form of a transparent photoconductive belt is trained about a series of rollers for movement through a path past a series of stations. Image member 1 is uniformly charged by a charging station 9 and imaged by exposure at a first exposure station, for example, an LED print-head 5, a laser, or the like, to form a first electrostatic

image. The first electrostatic image is of a first polarity as determined by the charge from charging station 9.

[0031] A first toner of a first color and a first polarity (for example, negative black toner) is applied to the first electrostatic image by a suitable toning station 7 to form a first toner image. Because the toner is negative in polarity, it adheres most densely to the most discharged portions of the first electrostatic image (DAD development).

[0032] The image member with the first toner image can be recharged by a charging station 6, again, to a negative potential (a step that may well not be necessary). Whether recharged or not, it is imagewise exposed by a second exposure station, for example, an LED printhead 12, laser, or the like, positioned behind image member 1 to create a second electrostatic image. This electrostatic image is toned by the application of positively charged toner of a second color (for example, red) from the previously shown second toning station 11. Alternatively, the second electrostatic image can be toned by application of positively charged toner of a third color, for example, yellow, from a third toning station 13.

[0033] Preferably, both toning stations 11 and 13 are constructed, as will be described with respect to FIG. 20, to provide a soft magnetic brush having a tendency to cause little disturbance to the first toner image and providing extremely high density at high speed with a relatively small station.

[0034] If the colors of the toners in toning stations 7 and 11 (or 13) are of different color, image member 1 now has a two color image. Obviously, the toners in stations 7 and 11 could be of the same color but different characteristics. For example, one of the two toners could be a black magnetic toner and the other a black non-magnetic toner, which arrangement would have certain advantages in certain processes. For purposes herein, such a combination of non-magnetic and magnetic black toners is essentially the same as a two color toner image.

[0035] The two color toner image proceeds to a treatment station made up of a corona charger 15 and an erase lamp 17. Corona charger 15 is biased to change the polarity of one of the toners making up the two color toner image. For example, it may apply a negative charge to the two color image, thereby changing the charge on the positive toner particles applied at either toning station 11 or toning station 13. As is well known in the art, this process can be assisted by use of an erase lamp 17 positioned at and/or before the corona charger 15 which further reduces the affinity of the toner for image member 1.

[0036] The treated two color image proceeds to the transfer station, including a transfer backing roller 23, where a potential is applied from a reversible potential source 19, encouraging transfer of the toner from a receiving sheet fed from a receiving sheet supply 21.

[0037] The receiving sheet is separated from image member 1 as image member 1 passes around a small

roller and is transported to a fuser 25 and eventually into an output tray 27. Cleaning station 29 cleans the image member 1 so that it can continue to be used in the process.

[0038] The above description describes operation of image forming apparatus 10 in carrying out the submethod described with respect to FIGS. 1-7. In carrying out the submethod described in FIGS. 8-14, exposing LED printhead 5 and toning station 7 are turned off while single color images are made using charging station 9, exposing LED printhead 12 and either of toning stations 11 or 13. Corona device 15 and erase lamp 17 are also turned off, and the bias applied from reversible voltage supply 19 to backing roller 23 is reversed so that the red or yellow toner applied by stations 11 and 13, in fact, transfers to the receiving sheet, while any black toner contained in either of those stations that is deposited in the background continues on on image member 1 to be cleaned off by cleaning device 29.

[0039] The submethod described with respect to FIGS. 15-18 is carried out by the image forming apparatus 10, for example, during cycle-up of the apparatus 10 when it is initially turned on for the day. During such cycle-up, while the fuser 25 is warming up, the image member 1 is driven through its endless path. LED printhead 12 and either or both of toning stations 11 and 13 are turned on. LED printhead 12 fully erases any charge on image member 1 and bias is applied to stations 11 and 13 which encourages the deposition of any black toner remaining in those stations onto image member 1. The black toner, being negative in polarity, is repelled by a strong negative bias on toning stations 11 and 13. Again, corona 15 and erase lamp 17 are turned off and transfer backing member 23 is articulated away from image member 1 to allow the black toner on image member 1 to continue to the cleaning device 29. Obviously, no sheet is fed from receiving sheet supply 21 for this portion of the operation. As mentioned above, backing member 23 can be maintained in place but biased to prevent the transfer of toner to it.

[0040] Operation of the image forming apparatus 10 is controlled by logic and control 100 which turns on and off all of the subsystems in appropriate timing, as is well known in the art. As shown in FIG. 19, it especially controls the bias applied to transfer backing roller 23 and the actuation of corona 15 and erase lamp 17 for working of the submethods shown in FIGS. 8-18. It also controls the bias on the development stations, including the bias applied to stations 11 and 13 during the subprocess shown in FIGS. 15-18.

[0041] FIG. 20 shows in detail a preferred embodiment of toning station 11 (and also station 13). Toning station 11, as shown in FIG. 20, embodies technology first disclosed in U.S. Patent No. 4,546,060, Miskinis et al, issued October 8, 1985, and further described in U.S. Patent No. 5,001,028 to Mosehauer et al (cited above). Toning station 11 includes a housing which defines a sump 39 in which a supply of developer is mixed

by suitable mixing augers 51. The developer includes "hard" magnetic carrier having a coercivity of at least 300 gauss, preferably in excess of 800 gauss, when magnetically saturated. The carrier exhibits an induced magnetic moment of at least 20 EMU per gram of carrier when in an applied field of 1,000 gauss. The toner is a typical insulative toner and is mixed thoroughly with the carrier (the combination generally being termed a "developer").

[0042] The developer is transported from sump 39 by a suitable transport device 53 to an applicator 41 for application to an electrostatic image carried by image member 1. Transport device 53 can include a valving feature, well known in the art, which can turn off the station by cutting off the supply of developer to applicator 41. Applicator 41 includes a rotatable magnetic core 43 positioned inside an also rotatable non-magnetic sleeve or shell 45. Although the core and shell can be rotated in either direction, most commercial embodiments rotate the core 43 at speeds of 1,000 revolutions per minute or higher in a clockwise direction to move the developer in a counter-clockwise direction around shell 45. If shell 45 is moved in a counter-clockwise direction, it also assists in the flow of developer. Alternatively, the developer can be driven in its counter-clockwise direction primarily by rotation of sleeve 45, and core 43 can also be rotated in a counter-clockwise direction. In this last case, the rotation of the core has primarily a mixing function as it actually encourages movement of the developer against the counter-clockwise direction that the developer is driven by the shell 45.

[0043] The rapidly rotating core causes rapid pole transitions on the surface of shell 45 which cause the high coercivity carrier to flip rapidly, usually in strings of carrier, as the developer moves through a development zone 55 between applicator 41 and image member 1. The flipping action moves the carrier from the shell to the image member and back rapidly, replacing lost charge and toner. This device and process have been in use for some years and provide highest quality development with a very soft magnetic brush. The softness of this brush was pointed out in the Mosehauer patent as useful in developing an electrostatic image on an image already carrying an unfixed toner image of a different color. The height of the developer nap is controlled, in part, by a skive 47, and the developer itself is skived off the sleeve 45 by another skive 49 so it can fall back into the sump 39 where it is mixed. The developer station itself is mounted opposite a pair of skis 60 which control the position of image member 1 with respect to applicator 41. Similarly, printhead 12 also includes one or two skis 62 which control the location of image member 1 with respect to it.

[0044] Although the core 43 and shell 45 are shown to have the same axis of rotation, some high quality commercial embodiments offset the core and shell axes. This strengthens the magnetic field in the development zone 55 and weakens it opposite the development

zone where developer is returned to the sump 39. This construction works especially well when the developer is being moved entirely by shell movement and the core is only mixing, since the skive 49 is relatively ineffective in such an embodiment.

[0045] The development station 11, as shown in FIG. 20, provides the highest quality of development available and accomplishes this with very high density at a very high toning speed. Because of the pole transitions and flipping of the strings of carrier themselves, this density and speed can be accomplished with a station of extremely modest size. When the softness of this brush is combined with the scavenging suppressing field associated with CAD developing, remarkably little scavenging occurs.

[0046] The invention has been described in detail with particular reference to a preferred embodiment thereof, but it will be understood that variations and modifications can be effected within the scope of the invention as defined in the appended claims.

Claims

1. An image forming method comprising:

forming a first electrostatic image of a first polarity on a first side of a photoconductive image member;
applying a first toner of the first polarity to the first electrostatic image to form a first toner image on said first side;
imagewise exposing the image member from a second side of the image member opposite the first side to form a second electrostatic image in registration with the first toner image; and
applying a second toner of a second polarity opposite the first polarity to the second electrostatic image to form a second toner image in registration with the first toner image.

2. An image forming method according to claim 1 wherein the step of applying a second toner to the second electrostatic image includes moving a developer containing a mixture of hard magnetic carrier particles and toner particles through a development zone in contact with the second electrostatic image.

3. An image forming method according to claim 2 wherein the step of applying a second toner includes subjecting the developer to rapid magnetic pole transitions while it is moving through the development zone.

4. An image forming method according to claim 3 wherein the developer is moved through the development zone at least in part by the rotation of a mag-

netic core inside a non-magnetic sleeve upon which the developer moves and said pole transitions are provided by the rotating magnetic core.

5. An image forming method according to claim 1 wherein the imagewise exposing step reduces the level of charge on the image member underneath the first toner image to a level less than the level of charge in exposed areas outside the first toner image.
6. An image forming method according to claim 5 wherein the step of applying a second toner includes applying the toner in the presence of an electric field of a direction discouraging removal of toner in the first toner image and discouraging the deposit of the second toner in the discharged portions of the second electrostatic image including the first toner image.

Patentansprüche

1. Verfahren zur Bilderstellung mit folgenden Schritten:

Erstellen eines ersten elektrostatischen Bildes einer ersten Polarität auf einer ersten Seite eines fotoleitfähigen Bildelements (1);

Aufbringen eines ersten Tonermaterials der ersten Polarität auf das erste elektrostatische Bild zum Erstellen eines ersten Tonerbildes auf der ersten Seite;

bildweises Belichten des Bildelements von einer zweiten Seite des Bildelements gegenüber der ersten Seite zum Erstellen eines zweiten elektrostatischen Bildes in Ausrichtung mit dem ersten Tonerbild; und

Aufbringen eines zweiten Tonermaterials einer zweiten Polarität, die entgegengesetzt zur ersten Polarität ist, auf das zweite elektrostatische Bild, um ein zweites Tonerbild in Ausrichtung mit dem ersten Tonerbild zu erstellen.

2. Verfahren zur Bilderstellung nach Anspruch 1, **dadurch gekennzeichnet, dass** der Schritt zum Aufbringen eines zweiten Tonermaterials auf das zweite elektrostatische Bild das Bewegen eines Entwicklers, der eine Mischung aus hartem magnetischen Trägerpartikeln und Tonerpartikeln enthält, durch eine Entwicklungszone in Kontakt mit dem zweiten elektrostatischen Bild umfasst.
3. Verfahren zur Bilderstellung nach Anspruch 2, **dadurch gekennzeichnet, dass** der Schritt zum Aufbringen eines zweiten Tonermaterials das Anlegen von schnellen Magnetpolübergängen an den Entwickler umfasst, während sich dieser durch die Ent-

wicklungszone bewegt.

4. Verfahren zur Bilderstellung nach Anspruch 3, **dadurch gekennzeichnet, dass** der Entwickler durch die Entwicklungszone zumindest teilweise durch Drehen eines Magnetkerns innerhalb einer nicht magnetischen Hülse (45) bewegbar ist, auf der sich der Entwickler bewegt, und dass die Polübergänge durch die Drehung des Magnetkerns (43) erzeugbar sind.
5. Verfahren zur Bilderstellung nach Anspruch 1, **dadurch gekennzeichnet, dass** der Schritt zur bildweisen Belichtung den Ladungspegel auf dem Bildelement unter dem ersten Tonerbild auf einen Pegel reduziert, der kleiner als der Ladungspegel in belichteten Bereichen außerhalb des ersten Tonerbildes ist.
6. Verfahren zur Bilderstellung nach Anspruch 5, **dadurch gekennzeichnet, dass** der Schritt zum Aufbringen eines zweiten Tonermaterials das Aufbringen des Tonermaterials in Anwesenheit eines elektrischen Feldes mit einer Richtung umfasst, die das Beseitigen von Toner in dem ersten Tonerbild hemmt und die Ablagerung des zweiten Tonermaterials in den entladenen Bereichen des zweiten elektrostatischen Bildes hemmt, dass das erste Tonerbild enthält.

Revendications

1. Procédé de formation d'images consistant à :

- former une première image électrostatique ayant une première polarité sur un premier côté d'un élément pour image photoconducteur ;
- appliquer un premier toner ayant la première polarité sur la première image électrostatique de manière à former une première image de toner sur ledit premier côté ;
- exposer un second côté de l'élément pour image, opposé au premier côté, de manière à former une seconde image électrostatique qui est alignée sur la première image de toner ; et
- appliquer un second toner ayant une seconde polarité, opposée à la première polarité, sur la seconde image électrostatique de manière à former une seconde image de toner qui est alignée sur la première image de toner.

2. Procédé de formation d'images, selon la revendication 1, dans lequel l'étape d'application d'un second toner sur la seconde image électrostatique consiste à faire se déplacer une substance révélatrice, qui contient un mélange de particules magnétiques solides porteuses et de particules de toner, à travers

une zone de développement de façon qu'elle entre en contact avec la seconde image électrostatique.

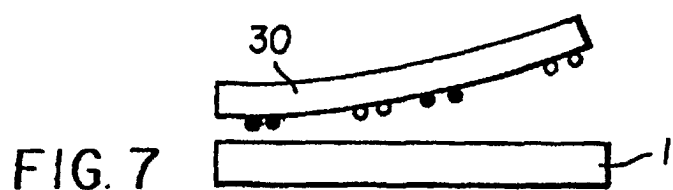
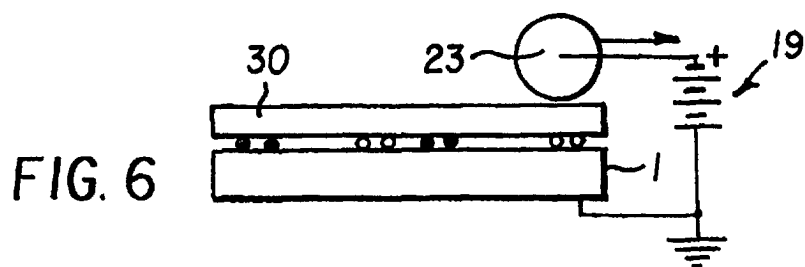
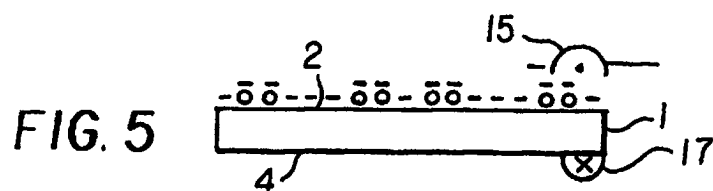
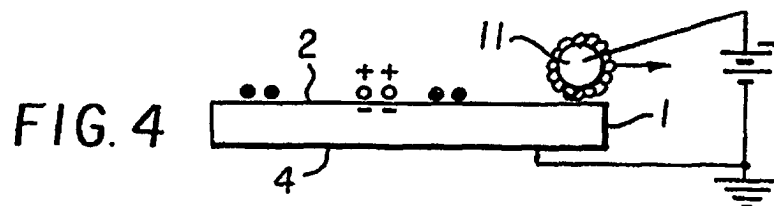
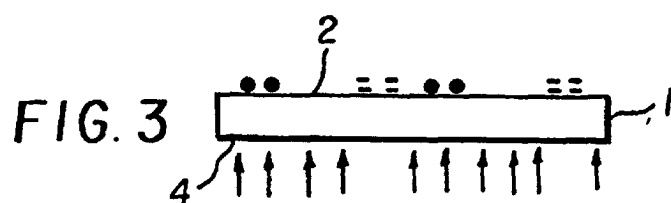
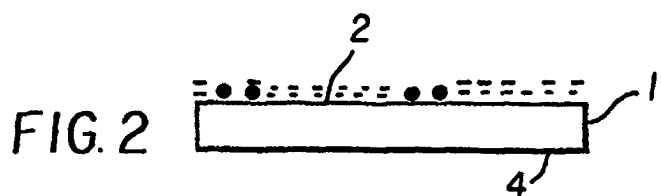
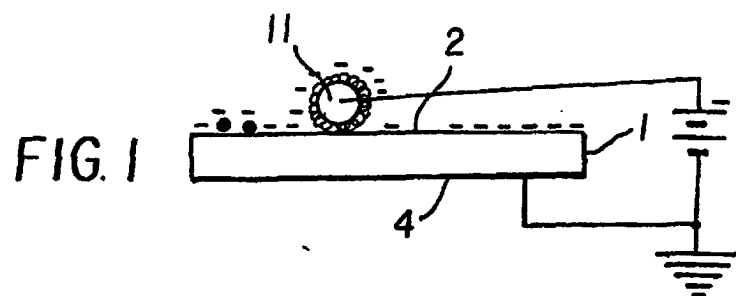
3. Procédé de formation d'images, selon la revendication 2, dans lequel l'étape d'application d'un second toner consiste à soumettre la substance révélatrice à des transitions de pôles magnétiques rapides pendant qu'elle se déplace à travers la zone de développement. 5
4. Procédé de formation d'images, selon la revendication 3, dans lequel la substance révélatrice se déplace à travers la zone de développement en partie au moins du fait de la rotation d'un noyau magnétique à l'intérieur d'un manchon non-magnétique sur lequel ladite substance révélatrice se déplace, lesdites transitions de pôles étant assurées par la rotation du noyau magnétique. 10 15
5. Procédé de formation d'images, selon la revendication 1, dans lequel l'étape d'exposition permet de réduire le niveau de charge sur l'élément pour image en dessous de la première image de toner à un niveau inférieur au niveau de charge dans les zones exposées à l'extérieur de la première image de toner. 20 25
6. Procédé de formation d'images, selon la revendication 5, dans lequel l'étape d'application d'un second toner consiste à appliquer le second toner en présence d'un champ électrique qui s'exerce dans une direction empêchant le retrait du toner dans la première image de toner et empêchant le dépôt du second toner dans les parties déchargées de la seconde image électrostatique comprenant la première image de toner. 30 35

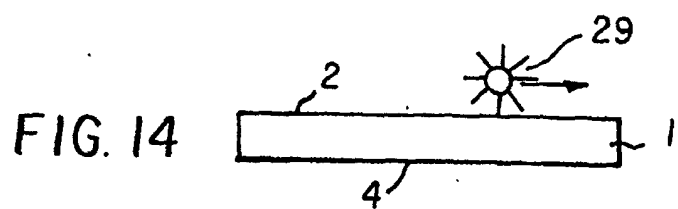
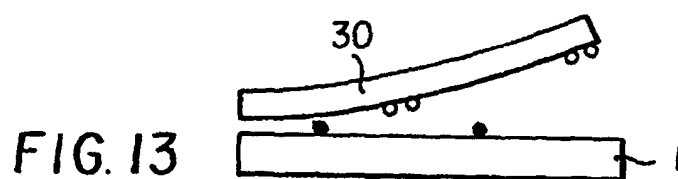
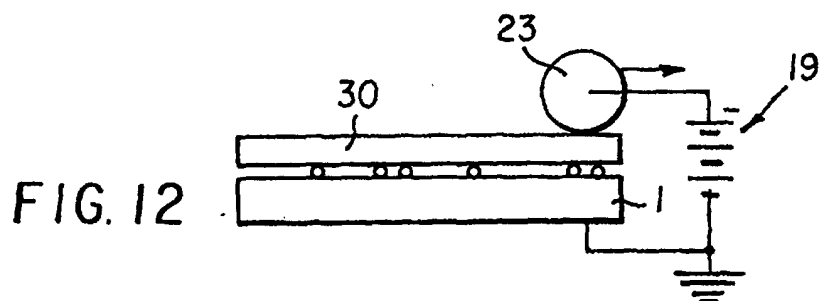
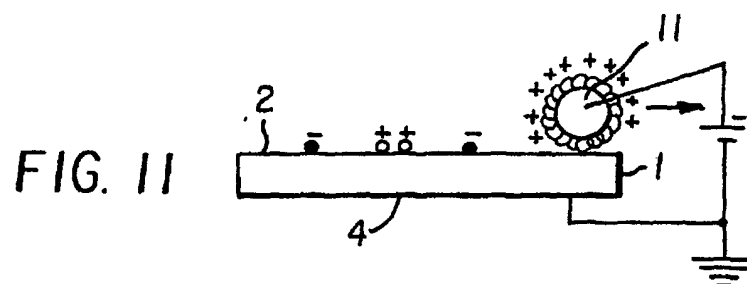
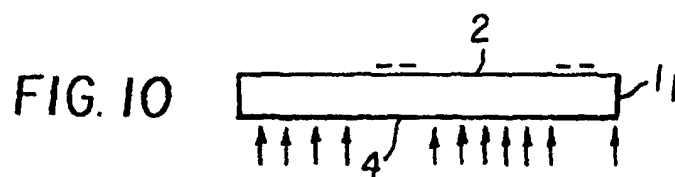
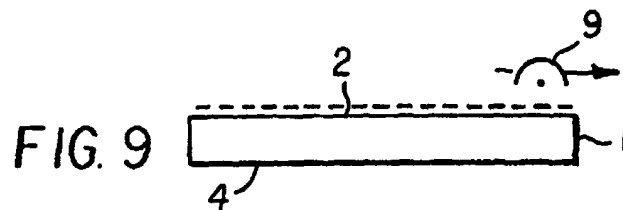
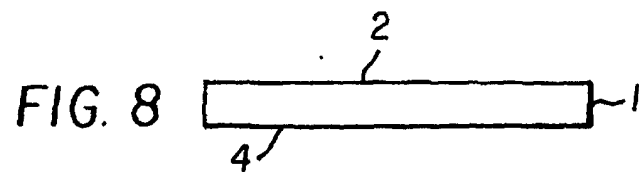
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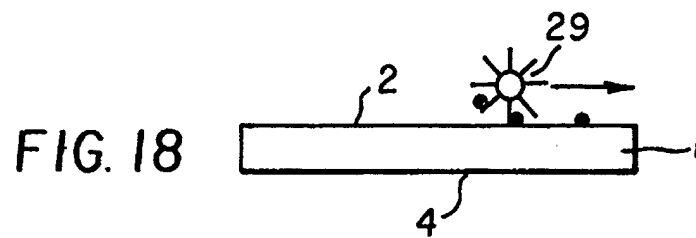
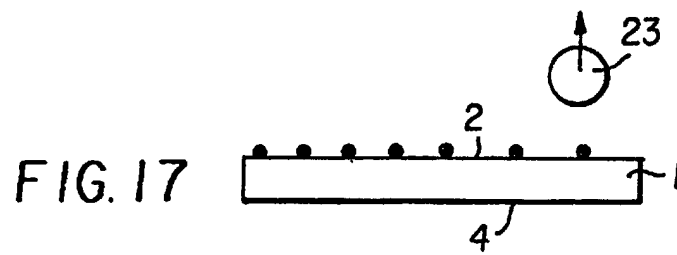
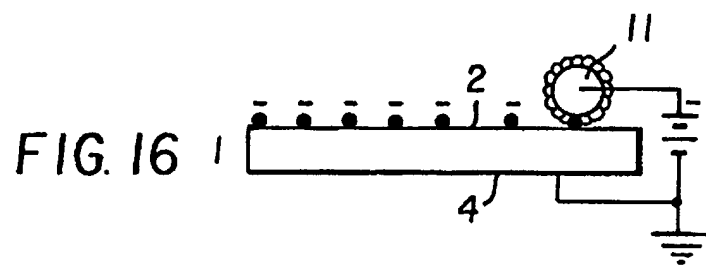
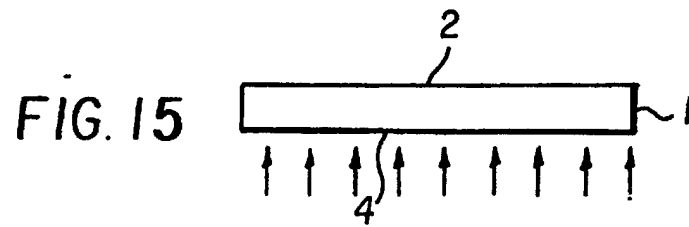
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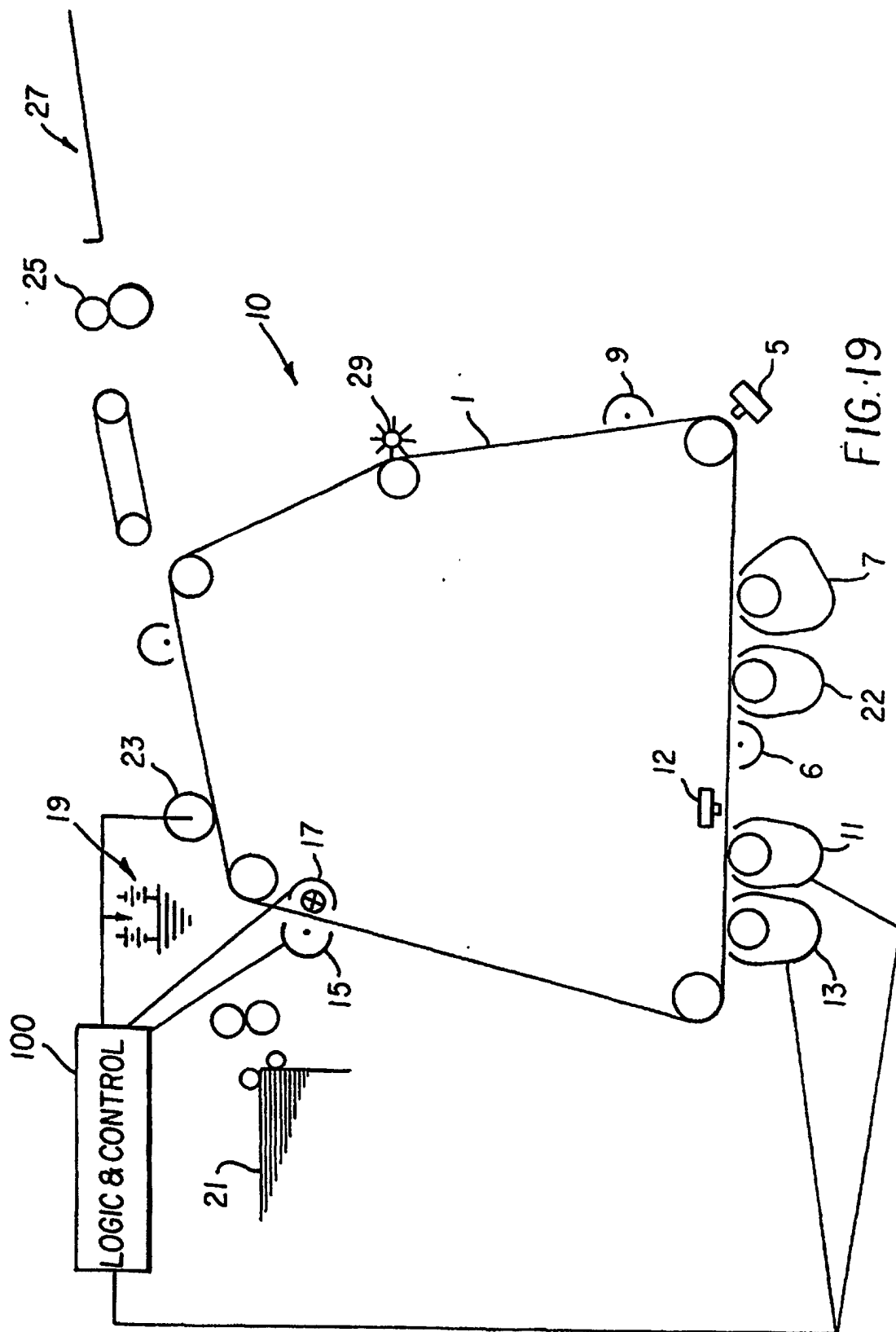
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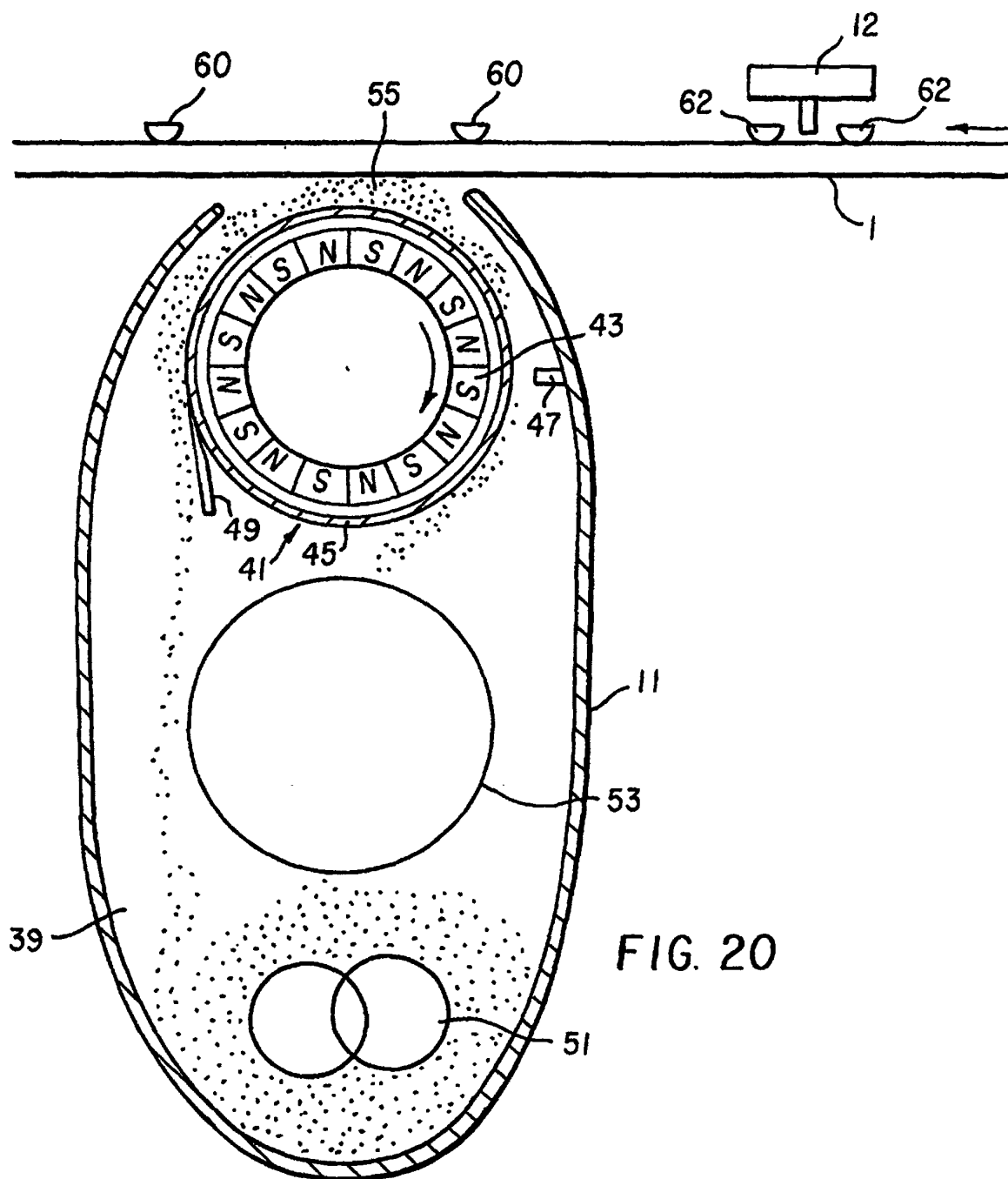


FIG. 20