

[54] HUMIDITY COMPENSATED CONTROL
DEVICE

[75] Inventor: Charles A. Whited, Rochester, N.Y.

[73] Assignee: Xerox Corporation, Stamford,
Conn.

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117/17.5

[51] Int. Cl. G03g 15/08

[58] Field of Search 355/3 R, 3 DD; 118/637,
118/7; 117/17.5

[56] References Cited

UNITED STATES PATENTS

3,348,523 10/1967 Davidson et al. 118/7

3,424,131 1/1969 Aser et al. 117/17.5 X

Primary Examiner—Robert P. Greiner

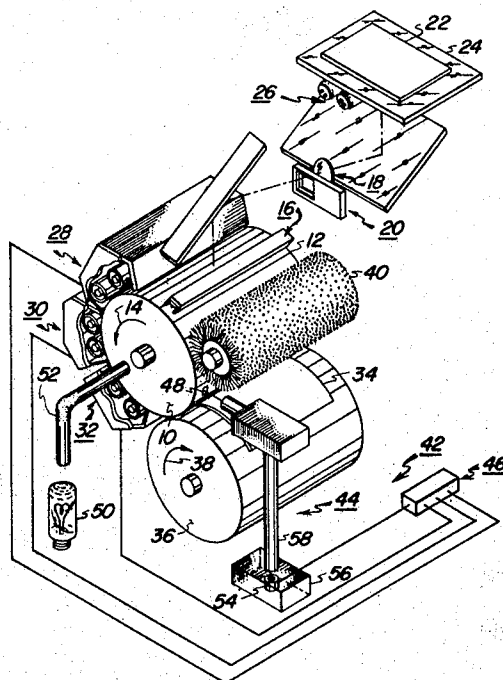
Attorney, Agent, or Firm—J. J. Ralabate; H. Fleischer;
C. A. Green

[57]

ABSTRACT

A humidity compensated control device in which the dispensing of particles from a particle storage container to a mix is regulated for maintaining the developability of the mix at a substantially optimum level.

10 Claims, 3 Drawing Figures



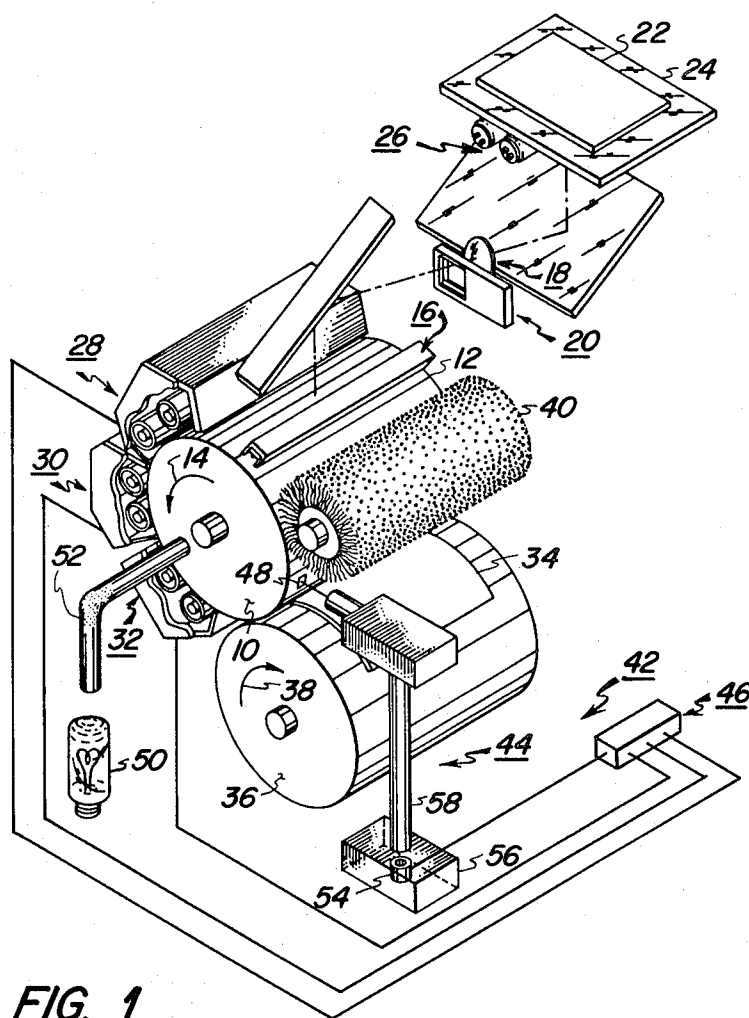


FIG. 1

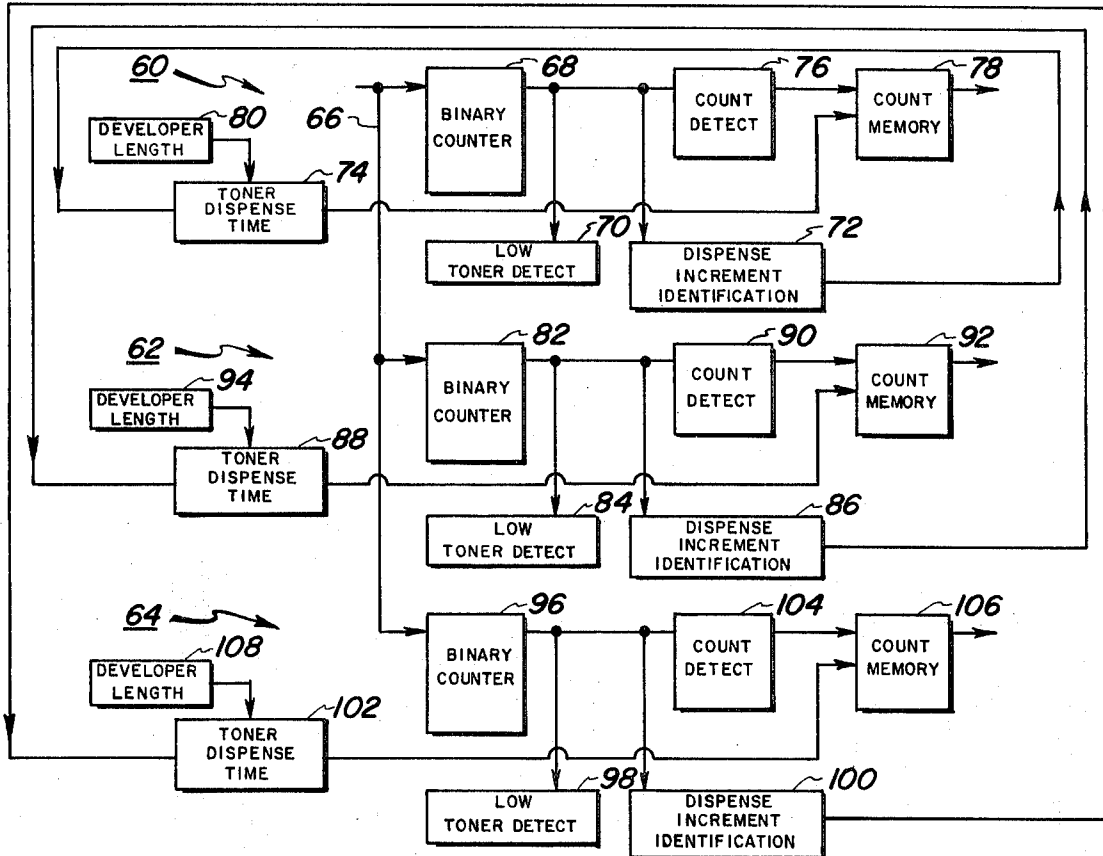


FIG. 2

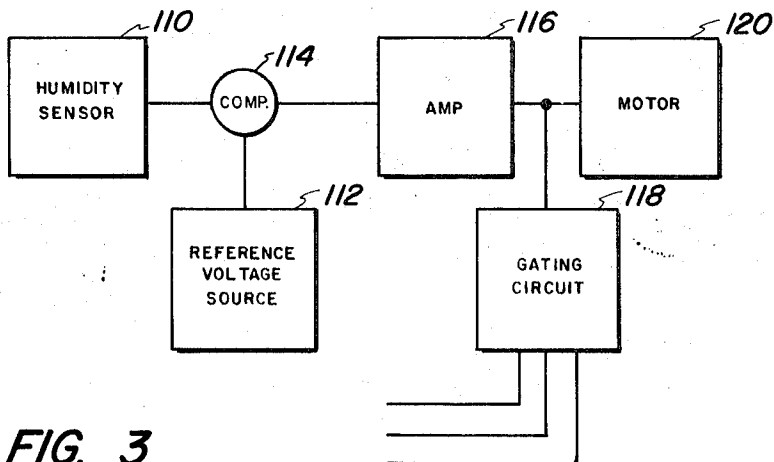


FIG. 3

HUMIDITY COMPENSATED CONTROL DEVICE**BACKGROUND OF THE INVENTION**

This invention relates generally to a multi-color electrophotographic printing machine, and more particularly concerns a humidity compensated control device which regulates the developability of copies formed thereon.

Developability, insofar as electrophotographic printing is concerned, can be defined as the ability of the developer mix used therein to create an image having a specified density. The characteristics of the developer mix are adjustable to produce developed images on a copy which have a suitable density and color balance. Developability is related to the concentration of toner particles within the developer mix, i.e. the percentage of toner particles relative to carrier granules in the developer mix. In addition, environmental conditions such as temperature and humidity conditions affect developability. As the humidity increases, the triboelectric characteristics of the toner particles decrease, thereby increasing the developability of the printing machine. Contrawise, as the humidity decreases, the triboelectric characteristics of the toner particles increase and the resultant developability of the printing machine decreases. It is, therefore, evident that two batches of substantially identical developer mix having the same concentration of toner particles therein with one batch located in a low humidity environment, will produce a multi-color copy having a substantially lighter image than that of a copy produced by another batch of developer mix located in a high humidity environment. This is particularly significant when the electrophotographic printing machine is initially energized. Under such circumstances, the surrounding environment has not yet stabilized and the humidity thereof may be substantially different from that of normal operating circumstances.

Various other types of systems have been devised to furnish toner particles to the developer mix. However, these systems dispense toner particles to the developer mix such that a pre-selected concentration thereof is maintained therein, no correction being made for humidity variations. For example, a system of this type is described in U.S. Pat. No. 3,399,652 issued to Gawron in 1968. The foregoing patent discloses a rotating reflective disc located directly in the developer mix sump. The disc is electrically biased to attract toner particles from the developer mix. The rate of toner particle attraction to the surface of the disc is dependent upon the complex interactions of the triboelectric quality with toner concentration humidity, toner particle impaction, and other variables of lesser significance. The intensity of a light beam, reflected from the surface of the disc onto a photoelectric unit, is a measure of the density of toner particles adhering to the disc surface. The photoelectric unit is suitably calibrated and develops a signal which actuates a toner dispensing apparatus. The dispensing apparatus replenishes the supply of toner particles in the developer mix when the density of toner particles adhering to the disc surface, as measured by the intensity of reflected light rays therefrom, is less than a minimum.

Many other systems of a similar nature may be described, however, none of the foregoing systems appear to compensate the rate of toner particle dispensing so

as to account for humidity variations in the surrounding environment. Thus, all of the systems heretofore utilized are adapted to dispense toner particles to the developer mix at a substantially constant rate irrespective of humidity variations in the surrounding environment. It is, therefore, evident that systems of this type do not correct the rate of toner particle dispensing as the humidity varies in the surrounding environment.

Accordingly, it is a primary object of the present invention to improve the control device for regulating the dispensing of particles from a particle storage container to a mix by compensating for humidity variations in the surrounding environment.

SUMMARY OF THE INVENTION

Briefly stated, and in accordance with the present invention, there is provided a humidity compensated control device for regulating the dispensing of particles from a particle storage container to a mix.

In the present instance, this is achieved by a combination of detecting means, circuit means, humidity correcting means and energizing means. The detecting means is adapted to generate an electrical signal indicative of the concentration of particles in the mix. A reference, developed by the circuit means, is compared with the electrical signal to produce an error signal corresponding to the difference therebetween. Pursuant to the present invention, humidity correcting means adjust the error signal to compensate for humidity variations in the surrounding environment. The humidity corrected error signal actuates the energizing means which, in turn, causes the particle storage container to dispense particles therefrom into the mix.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and advantages of the present invention will become apparent upon reading the following detailed description and upon reference to the drawings, in which:

FIG. 1 is a schematic perspective view of an electrophotographic printing machine embodying the features of the present invention therein;

FIG. 2 is a block diagram of the circuitry used in the FIG. 1 printing machine to produce an error signal indicative of the deviation between the desired toner particle concentration in the developer mix and the actual concentration thereof; and

FIG. 3 is a block diagram of the circuitry utilized in conjunction with the FIG. 2 block diagram to correct the error signal therefrom for humidity variations in the surrounding environment.

While the present invention will be described in connection with a preferred embodiment, it will be understood that it is not intended to limit the invention to that embodiment. On the contrary, it is intended to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

DETAILED DESCRIPTION OF THE INVENTION

With continued reference to the drawings, FIG. 1 illustrates a multi-color electrophotographic printing machine in which the present invention may be incorporated. In the following drawings, like reference numerals have been used throughout to designate like elements. FIG. 1 depicts schematically the various components utilized in the electrophotographic printing ma-

chine to produce multi-color copies from a colored original. Although the humidity compensated control device of the present invention is particularly well adapted for use in an electrophotographic printing machine, it should become evident from the following description that it is equally well suited for use in a wide variety of electrostatographic printing machines and is not necessarily limited to the particular embodiment shown herein.

As shown in FIG. 1, the electrophotographic printing machine employs a drum 10 having a photoconductive surface 12 entrained about the circumferential surface thereof and secured suitably thereto. Drum 10 is mounted rotatably within the machine frame (not shown), and adapted to be driven by a drive motor (not shown) in the direction of arrow 14. In this manner, as drum 10 rotates, photoconductive surface 12 passes sequentially through a series of processing stations. A timing disc mounted in the region of one end of the shaft of drum 10 is arranged to trigger the printing machine logic circuitry for actuating the various processing stations at the appropriate time. Drum 10 and the other operating mechanisms of the printing machine are driven at a pre-determined speed relative to one another from the drive motor. Hence, the various machine operations are coordinated relative to each other by the machine logic to produce the proper sequence of events at each of the processing stations.

Referring once again to FIG. 1, drum 10 initially rotates photoconductive surface 12 through charging station A. At charging station A, a corona generating device, indicated generally at 16, sprays ions on photoconductive surface 12. In this manner, photoconductive surface 12 is charged to a substantially uniform potential. Preferably, corona generating device 16 extends in a generally longitudinal direction transversely across photoconductive surface 12. U.S. Pat. No. 2,778,946 issued to Mayo in 1957 discloses one type of suitable corona generating device for use in the multi-color electrophotographic printing machine described in FIG. 1.

After photoconductive surface 12 is charged to a relatively high substantially uniform potential, drum 10 rotates to exposure station D. At exposure station D, a color filtered light image of the original document is projected onto charged photoconductive surface 12. The areas of photoconductive surface 12, irradiated by the light image, are selectively discharged creating an electrostatic latent image of the original document thereon. Exposure station B includes a moving lens system, generally designated by the reference numeral 18, and a color filter mechanism shown generally at 20. An original document 22, such as a sheet of paper, book, or the like is placed face down upon transparent viewing platen 24. Lamp assembly 26, filter mechanism 20 and lens system 18 are moved in a timed relationship with drum 10 to scan successive incremental areas of original document 22 disposed upon platen 24. In this way, a flowing light image of original document 24 is projected onto photoconductive surface 12. During exposure, filter mechanism 20 interposes selected color filters into the optical light path of lens 18. The color filter operates on the light rays passing through lens 18 to record an electrostatic latent image on photoconductive surface 12 corresponding to a preselected spectral region of the electromagnetic wave spectrum, hereinafter referred to as a single color electrostatic latent

image. One type of suitable moving lens system is disclosed in U.S. Pat. No. 3,062,108 issued to Mayo in 1962. A suitable color filter mechanism is described in co-pending application Ser. No. 830,282 filed in 1969.

Thereafter, drum 10 rotates the single color electrostatic latent image recorded on photoconductive surface 12 to development station C. Development station C includes three individual developer units, generally indicated by the reference numerals 28, 30 and 32, respectively. A suitable development station employing a plurality of developer units is disclosed in co-pending application Ser. No. 255,259, filed in 1972. Preferably, the developer units are all of a type generally referred to as magnetic brush developer units. A typical magnetic brush unit utilizes a magnetizable developer mix which includes carrier granules and toner particles. The developer mix is continually brought through a directional flux field to form a brush thereof. The electrostatic latent image recorded on photoconductive surface 12 is developed by bringing the brush of developer mix into contact therewith. Each of the respective developer units contains discretely colored toner particles corresponding to the complement of the spectral region of wave length of light transmitted through filter 20. For example, a green filtered electrostatic latent image is made visible by depositing green absorbing magenta toner particles thereon. Similarly, blue and red latent images are developed with yellow and cyan toner particles, respectively.

Drum 10 is next rotated to transfer station D where the toner powder image adhering electrostatically to photoconductive surface 12 is transferred therefrom to a sheet of final support material 34. Final support material 34 may be, amongst others, plain paper or a sheet of polysulfone thermoplastic material. Preferably, support material 34 is releasably secured to a transfer roll, shown generally at 36. Transfer roll 36 recirculates support material 34 and is biased electrically to a potential of sufficient magnitude and polarity to attract electrostatically toner particles from the latent image recorded on photoconductive surface 12 to support material 34. As shown in FIG. 1, transfer roll 36 is adapted to rotate in the direction of arrow 38. Transfer roll 36 rotates in synchronism with drum 10 (in this case, at the same angular velocity therewith). Inasmuch as support material 34 is secured to transfer roll 36, for movement in a recirculating path therewith, successive toner powder images may be transferred thereto superimposed in registration with one another. A suitably electrically biased transfer roll is described in U.S. Pat. No. 3,612,677 issued to Langdon et al. in 1971.

After a plurality of toner powder images have been transferred to support material 34, support material 34 is removed from transfer roll 36 and advanced to a suitable fuser (not shown) which permanently affixes the multi-layered toner powder image thereto. One type of suitable fuser is described in U.S. Pat. No. 3,498,592 issued to Moser et al. in 1970. After the fixing process, support material 34 is advanced by a plurality of endless belt conveyors (not shown) to a catch tray (not shown) for subsequent removal therefrom by the machine operator.

Although a preponderance of the toner particles are transferred to support material 34, invariably some residual toner particles remain on photoconductive surface 12 after the transfer of the toner powder image

thereto. These residual toner particles are removed from photoconductive surface 12 as it passes through cleaning station E. At cleaning station E, the residual toner particles are initially brought under the influence of a cleaning corona generating device (not shown) adapted to neutralize the electrostatic charge remaining on the toner particles and photoconductive surface 12. The neutralized toner particles are then cleaned from photoconductive surface 12 by a rotatably mounted fibrous brush 40. Rotatably mounted brush 40 is positioned at cleaning station E and maintained in contact with photoconductive surface 12. Hence, residual toner particles remaining on photoconductive surface 12 after each successive transfer operation are readily removed therefrom. A suitable brush cleaning device is described in U.S. Pat. No. 3,590,412 issued to Gerbasi in 1971.

It is believed that the foregoing description is sufficient for purposes of the present application to illustrate the general operation of a multi-color electrophotographic printing machine embodying the teachings of the present invention therein.

Pursuant to the present invention, additional toner particles may be added to the respective developer mix when developability, as hereinbefore described, is reduced deleteriously. The humidity compensated control device of the present invention is adapted to regulate the rate of dispensing toner particles to the respective developer mix in accordance with the requirements thereof. With continued reference to FIG. 1, the humidity corrected control device, indicated generally at 42, includes detecting means, indicated generally at 44, circuit means and humidity correcting means, indicated generally at 46, and energizing means 20 (FIG. 3). Detecting means 44 includes a transparent electrode assembly 48 mounted on photoconductive surface 12 of drum 10. Preferably, electrode 48 is a glass slug having a tin oxide coating thereon and is manufactured by Pittsburgh Plate Glass Company under the trade-name NESA. A light source 50 cooperates with fiber optic light pipe 52 to transmit light rays through transparent electrode assembly 48. Light source 50 may preferably be a five volt derated tungsten lamp. During the development process, transparent electrode 48 is biased electrically to attract toner particles thereto. Preferably, electrode 48 is biased to about 200 volts greater than the magnetic brush electrical bias of about 500 volts. The toner particles are deposited on transparent electrode 48 during development and the intensity of the light rays passing therethrough is indicative of the density thereof. A photosensor 54, such as a cadmium sulfide photocell, located in an oven 56, is in light receiving relation with the light rays transmitted through transparent electrode 48. The light rays pass through transparent electrode 48 to photosensor 50 via fiber optic light pipe 58. Photosensor 50 produces an electrical output signal corresponding to the intensity of the rays passing therethrough. The structural configuration of detecting means 44 is described in greater detail in co-pending application Ser. No. 213,056 filed in 1971. Circuit means and humidity correcting means 46 produce a humidity corrected error signal for actuating the respective energizing means which causes the respective storage container to dispense toner particles therefrom. Preferably, each toner storage container is oscillated about its longitudinal axis so as to dispense toner particles therefrom through perforations therein.

A suitable oscillator motor is utilized to vibrate each of the toner storage containers in response to the humidity corrected error signal.

Turning now to FIG. 2, there is shown a logic block diagram of the circuit arrangement for developing an error signal dependent upon toner density conditions. As shown therein, there are three independent logic channels, each of the logic channels being associated with one of the toner particle storage containers. Logic channel 60 is associated with the cyan toner particles, logic channel 62 is associated with the magenta toner particles, and logic channel 64 is associated with the yellow toner particles. An electrical output signal from detecting means 44 is transmitted on line 66 to binary counter 68 of the appropriate logic channel, in this case, the cyan logic channel. Binary counter 68 sums the number of electrical outputs from detecting means 44. If the total number of electrical signals exceeds the binary number 10, i.e. 1010, low toner detection logic block 70 is actuated and the toner container oscillator motor deenergized. If the door to the housing of the toner storage container in the printing machine is opened and closed, i.e. adding additional toner particles to the toner storage container, the low toner condition is removed and the binary counter reset to zero. In addition, an electrical output signal from binary counter 68 actuates dispense increment identification logic block 72 which, in turn, actuates toner dispense logic block 74. Toner dispense logic block 74 determines the length of time that the oscillator motor is vibrated, thereby defining the length of each toner dispense from the toner particle storage container. Thus, if identification block 72 indicates that from one to three electrical output signals have been obtained from detecting means 44, i.e. 0001 to 0010 or 0011, the left two binary numbers even (00), the toner dispense time will be a half dispense, whereas if identification block 72 indicates that the number of electrical output signals from detecting means 44 ranges from 4 to 10, i.e. 0100, 0101, 0110, 0111, 1000, 1001 or 1010, the left two binary numbers being odd (01 or 10), the toner dispense time will be a full dispense time. The output signal from binary counter 68 actuates count detect logic block 76, which in turn energizes memory of a count logic block 78. Count detector logic block 76 verifies that there has been a request for toner particles and logic memory block 78 provides the toner dispense signal. Logic memory block 78 is energized by the toner dispense signal from toner dispense time logic element 74 and from count detector logic block 76. When electrical signals from count detector logic block 76 and logic element 74 are present, memory logic element 78 is actuated. Logic element 78 develops a toner dispense signal of the appropriate length, the amplitude of which is compensated for humidity conditions by the humidity compensating circuit of FIG. 3. The humidity compensated error signal energizes the oscillator motor of the appropriate toner particle storage container, in this case the cyan storage container. Developer length logic block 80 is interconnected with cyan developer unit 32 and determines the length of time that the cyan developer unit is actuated.

Logic channels 62 and 64 are essentially duplicates of logic channel 60. The foregoing logic channels will be described briefly hereinafter. Logic channel 62 actuates the magenta toner storage container and includes a binary counter 82 adapted to count the num-

ber of electrical output signals from detecting means 44. When binary counter 82 indicates that the total number of electrical output signals from detecting means 44 exceeds the binary number 10, low toner detector 84 inhibits toner particle dispensing. Toner dispense increment identifier 86 indicates when the total number of electrical counts is intermediate the binary numbers 4 and 10. The signal therefrom energizes toner dispense time blocks 88 which permits a full dispense signal to be developed. Count detector 90 is actuated by a signal from binary counter 82. A signal from count detector 90 and a signal from toner dispense time block 88 actuates binary member 92. If, however, from one to three electrical output signals have been summed from detecting means 44, logic element 88 will reduce the dispense time in half. The error signal from binary member 92 is compensated for humidity variations in the surrounding environment by the humidity correcting circuit of FIG. 3. The humidity corrected error signal actuates the motor which oscillates the toner dispenser for a discrete time interval with a variable amplitude dependent upon humidity conditions. Thus, the toner storage container oscillator motor will be energized with the appropriate amplitude to dispense toner particles into the magenta developer mix at the correct rate, thereby maintaining the developability thereof at a predetermined level. Developer length logic block 94 is interconnected with magenta developer 30, and determines the length of time that magenta unit 30 is actuated.

In a similar fashion, logic channel 64 develops a full or half dispense signal for the yellow toner storage container. As depicted in FIG. 2, binary counter 96 sums the number of electrical output signals from detecting means 44. If binary counter 96 indicates that in excess of 10 electrical output signals have been produced by detecting means 44, low toner detection logic block 98 is actuated. Low toner detection logic block 98, thereupon, inhibits yellow toner particle dispensing. The output signal from binary counter 96 also actuates dispense increment identification logic block 100 which determines whether binary counter 96 indicates an electrical output signal from detecting means 44 that is less or equal to the binary number 3, or ranges from 4 to 10. Dispense increment identification block 100 actuates dispense time logic block 102. The output signal from binary counter 96 actuates count detector 104. The signal from dispense time logic block 102 and count detector 104 actuates memory counter 106. The error signal from memory counter 106 is corrected for humidity variations in the surrounding environment by the circuit depicted in FIG. 3. The humidity corrected error signal energizes the yellow toner storage container oscillator motor at the appropriate amplitude for the discrete time prescribed. Thus, if 1 to 3 detector electrical signals have been sensed, the yellow logic channel oscillator motor is energized for a half dispense cycle, the amplitude of oscillation being modified to account for humidity variations. However, if 4 to 10 electrical output signals have been sensed from detecting means 44, the oscillator motor of the yellow toner storage container is actuated for a full dispense cycle, the amplitude being modified by humidity variations. Developer length logic block 108 is interconnected with yellow developer unit 28 and determines the length of time that yellow developer unit 28 is actuated.

The preferred logic elements utilized to form each of the logic blocks heretofore discussed and illustrated in FIG. 2 are described, in detail, in co-pending application Ser. No. 351,741, filed in Apr. of 1973, the disclosure of which is hereby incorporated into the present application.

While the invention has been described in connection with a humidity compensated control device which varies toner particle dispensing by adjusting the amplitude of oscillation, one skilled in the art will appreciate that the invention is not necessarily so limited and that the amplitude of oscillation may be maintained substantially constant while the length of toner particle dispense time is corrected for humidity variations.

Referring now to FIG. 3, there is shown the detailed circuitry for the humidity correcting means. Humidity sensing means or a temperature compensated lithium chloride cell 110, manufactured under the tradename Dunmore cell, is connected in a suitable wheatstone bridge arrangement to provide an indication of the humidity in the surrounding environment. Preferably, lithium chloride cell 110 has a high resistance when the humidity is low and a low resistance when the humidity is high, i.e. the resistance is inversely proportional to the humidity. Hence, the change in resistance of lithium chloride cell 110 is a measure of the change in humidity in the surrounding environment. Therefore, it is apparent to one skilled in the art that the lithium chloride cell 110 may be readily interconnected in a wheatstone bridge circuit to provide a voltage output indicative of humidity changes in the surrounding environment. Reference producing means or voltage source 112 produces a voltage indicative of the nominal humidity in the surrounding environment. The voltage output from the wheatstone bridge having lithium chloride cell 110 therein is compared with that of the reference from voltage source 112 in a suitable comparator, preferably resistance comparator 114. The error signal is indicative of the deviation from the nominal to the actual humidity. Signal amplifier 116 amplifies and appropriately conditions the error signal. The output signals from binary memory logic units 78, 92 and 106, respectively, (FIG. 2) are inputs to gating circuit 118. Gating circuit 118 permits the appropriate toner dispense signal to pass therethrough when the circuitry of FIG. 2 indicates that additional toner particles are required in one of the developer mixes hereinbefore described. The electrical output signal from gating circuit 118 is corrected for humidity variations by the humidity error signal from amplifier 116. The humidity corrected error signal actuates energizing means or oscillator motor 120 which, in turn, vibrates the appropriate toner storage container about its longitudinal axis at a prescribed amplitude dependent upon the humidity corrected error signal. The length of time is fixed, i.e. either a full or half dispense time. In this manner, the rate of toner particle dispensing from the toner storage container to the developer mix is regulated for more efficiently maintaining the developability of the system substantially constant irrespective of humidity variations in the surrounding environment.

In recapitulation, the humidity compensated control device of the present invention improves the developability of a multi-color copy by regulating the concentration of toner particles within the developer mix in response to the density of toner particles deposited on a simulated electrostatic latent image, and varies the rate

of system response in accordance with humidity variations in the surrounding environment. Thus, the control device insures that the image density and color balance of the colored copy are repeatable and of the desired quality.

It is, therefore, apparent that there has been provided, in accordance with the present invention, a humidity corrected control device for regulating the developability of a development system that fully satisfies the objects, aims, and advantages set forth above. While this invention has been described in conjunction with specific embodiments thereof, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art. Accordingly, it is intended to embrace all such alternatives, modifications, and variations that fall within the spirit and broad scope of the appended claims.

What is claimed is:

1. A humidity compensated control device for regulating the dispensing of particles from a particle storage container to a mix, including:

means for detecting the developability characteristics of the mix, said detecting means being adapted to generate an electrical signal indicative of the developability of the mix;

circuit means for comparing the electrical signal from said detecting means with a reference developed therein to produce an error signal corresponding to the difference therebetween;

means for correcting the error signal from said circuit means to compensate for humidity variations in the surrounding environment; and

means, responsive to the humidity corrected error signal, for energizing the particle storage container to dispense particles therefrom into the mix so as to adjust the developability of the mix.

2. A device as recited in claim 1, wherein said humidity correcting means includes:

means for sensing the humidity in the surrounding environment, said humidity sensing means being adapted to generate an electrical signal indicative thereof;

means for producing a reference signal corresponding to a nominal humidity condition; and

means for comparing the electrical signal from said humidity sensing means to the reference from said producing means for developing an error signal arranged to correct the electrical signal from said circuit means.

3. A device as recited in claim 2, wherein said detecting means includes:

electrode means biased electrically to attract particles thereto as said electrode means passes through the mix;

means for illuminating said electrode means having particles deposited thereon with light rays; and

means for sensing the intensity of the light rays transmitted from said electrode means and producing an electrical signal indicative of the density of particles deposited thereon.

4. A device as recited in claim 1, wherein said circuit means includes means for summing said detecting means electrical signals and providing a first error signal beneath a first pre-selected number of electrical signals, and a second error signal intermediate the first pre-selected number and a second pre-selected number of electrical signals.

5. A device as recited in claim 4, wherein said energizing means includes a motor adapted to oscillate the particle storage container at varying amplitudes for a preselected time interval, said motor being actuated by the humidity corrected error signal and the amplitude of oscillation being dependent thereon.

6. An electrophotographic printing machine having a photoconductive member arranged to pass through a developer mix, wherein a humidity compensated control device regulates the dispensing of toner particles from a toner particle storage container to the developer mix of a developer unit disposed therein, including:

means, mounted on the photoconductive member, for attracting toner particles thereto as the photoconductive member passes through the developer mix and for detecting the density of toner particles deposited thereon, said attracting and detecting means being adapted to generate an electrical signal indicative of the density of toner particles attracted thereto;

circuit means for comparing the electrical signal from said attracting and detecting means with a reference developed therein to produce an error signal corresponding to the differences therebetween;

means for correcting the error signal from said circuit means to compensate for humidity variations in the surrounding environment; and

means, responsive to the humidity corrected error signal, for energizing the toner particle storage container to dispense toner particles therefrom into the developer mix.

7. A printing machine as recited in claim 6, wherein said humidity correcting means includes:

means for sensing the humidity in the surrounding environment, said humidity sensing means being adapted to generate an electrical signal indicative thereof;

means for producing a reference signal corresponding to a nominal humidity condition; and

means for comparing the electrical signal from said humidity sensing means to the reference from said producing means for developing an error signal arranged to correct the electrical signal from said circuit means.

8. A printing machine as recited in claim 7, wherein said attracting and detecting means includes:

electrode means mounted on the photoconductive member and electrically biased to attract toner particles thereto as the photoconductive member passes through the developer mix;

means for illuminating said electrode means having the toner particles deposited thereon with light rays; and

means for sensing the intensity of light rays transmitted from said electrode means and producing an electrical signal indicative of the density of particles deposited thereon.

9. A printing machine as recited in claim 6, wherein said circuit means includes means for summing said attracting and detecting means electrical signals and providing a first error signal beneath a first pre-selected number of electrical signals, and a second error signal intermediate the first pre-selected number and a second preselected number of electrical signals.

10. A printing machine as recited in claim 9, wherein said energizing means includes a motor adapted to oscillate the toner particle storage container at varying amplitudes for a pre-selected time interval, said motor being actuated by the humidity corrected error signal and the amplitude of oscillation being dependent thereon.