

[72] Inventor Ernest P. Kollar
Broomfield, Colorado
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[73] Assignee International Business Machines Corporation
Armonk, New York
a corporation of New York

[56]

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Primary Examiner—William B. Penn

Attorney—Littlepage, Quaintance, Wray and Aisenberg

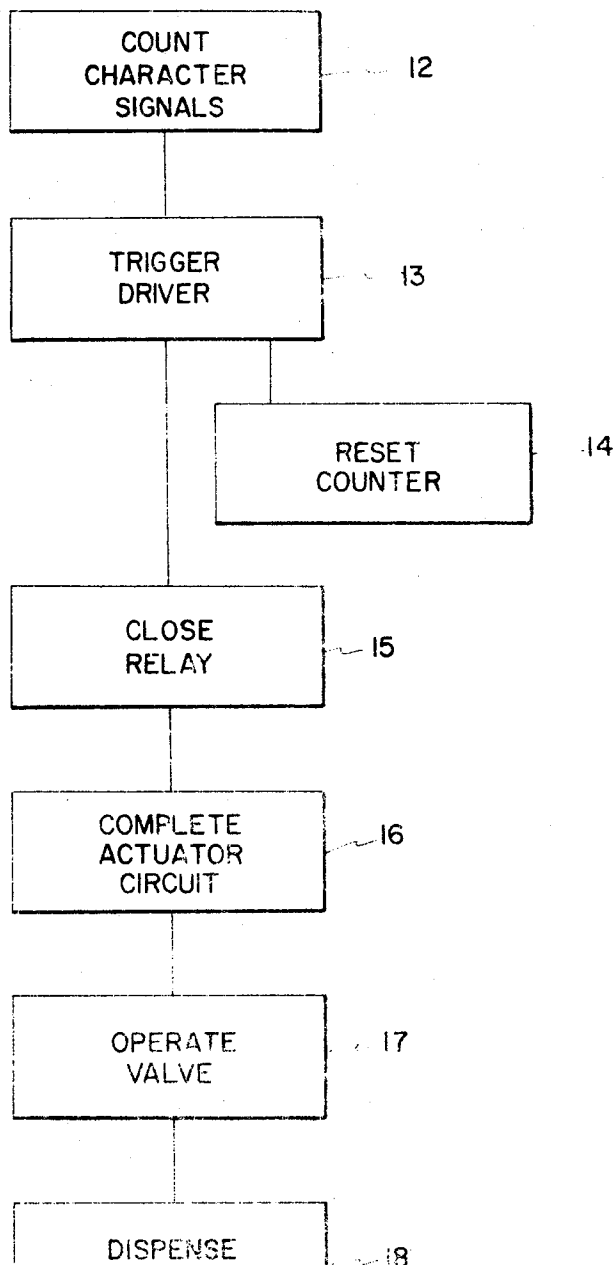
[54] **PRINTING SUBSTANCE CONTROL**
4 Claims, 3 Drawing Figs.

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95/1.7, 118/637, 222/57, 101/335

[51] Int. Cl..... B41c 3/00,
B05b 5/02, B67d 5/08

[50] Field of Search..... 101/335,
365, 364, 363, 350, 360, 426; 118/637; 346/74;
222/52, 56, 57, 409; 95/1.7; 96/355(Inquired)

ABSTRACT: Sensing and counting character print signals of a high speed electric printing apparatus, and replenishing a supply of printing substance in relation to the number of print signals sensed; and interconnected counters, drivers, relays, actuators and metering means for counting character print signals and for metering a printing substance from a container in response to a print signal count are described herein.



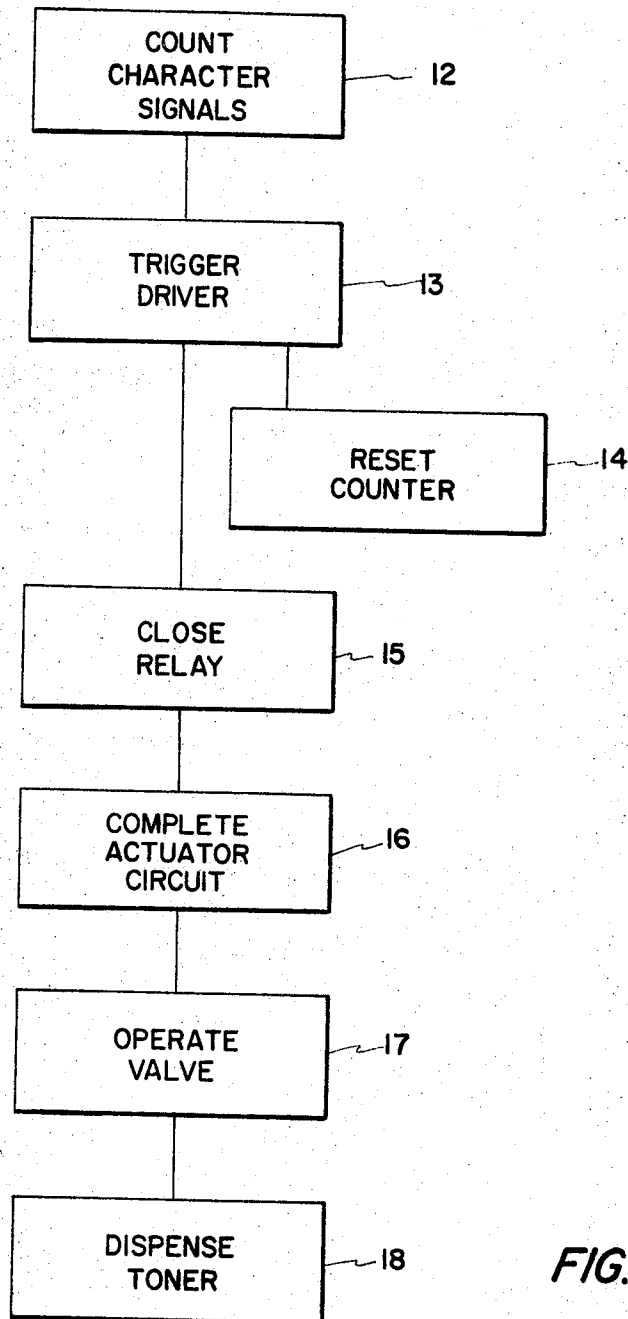


FIG. 1

INVENTOR
ERNEST P. KOLLAR

BY *Littlepage, Quaintance & Wray*
ATTORNEYS

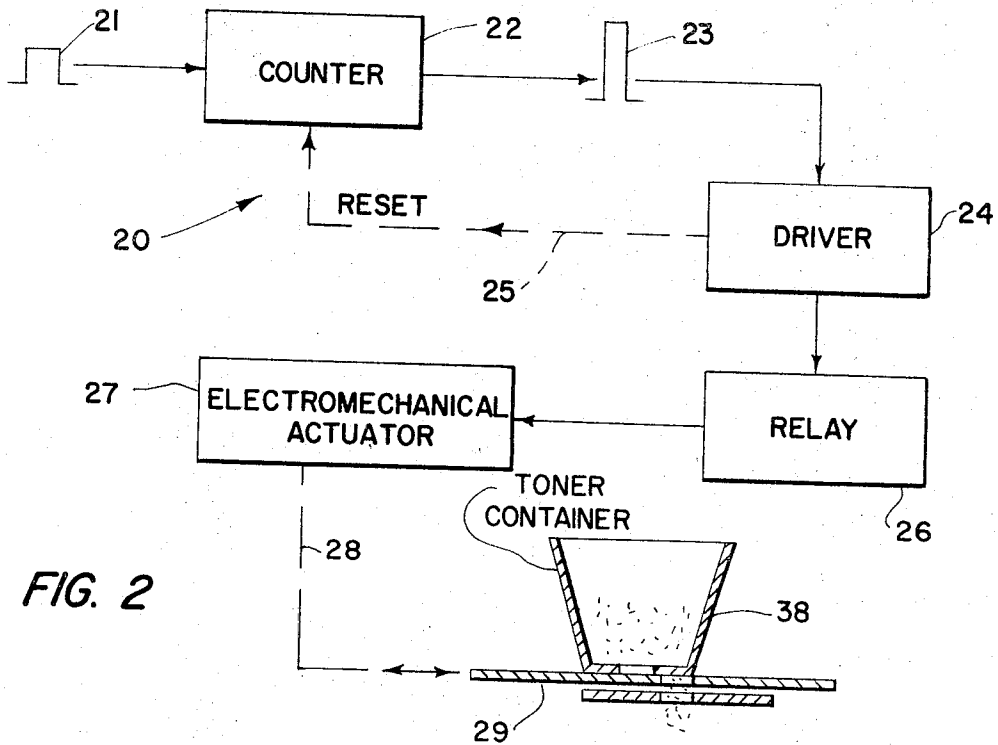


FIG. 2

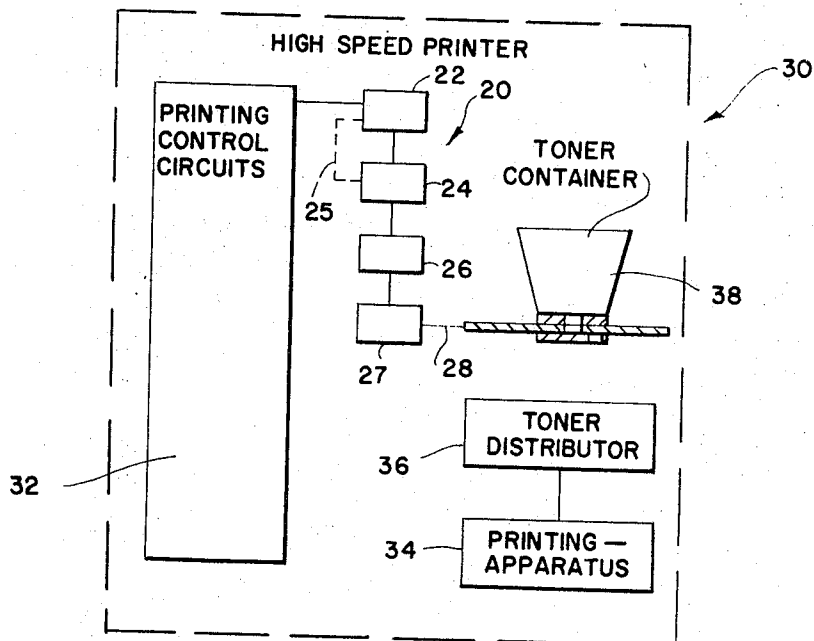


FIG. 3

INVENTOR
ERNEST P. KOLLAR

BY *Littlepage, Quaintance & Wray*
ATTORNEYS

PRINTING SUBSTANCE CONTROL

SUMMARY OF INVENTION

This invention relates to the systematic replenishing of a printing substance upon the sensing of a given number of characters printed or to be printed

In high speed printing equipment it is very important that a supply of printing substance be kept substantially constant to maintain uniformity of printing. Greater or lesser supplies of the printing substance vary the intensity and color of the product and may cause a printed sheet to be blurred or faint. It is important that the supply be restored to a suitable operating level at frequent intervals to maintain a product of uniform quality.

If replenishment is effected manually at long intervals, the supply fluctuates sufficiently to cause variations in the product. If manual replenishment is done at short intervals, the task becomes onerous and time consuming, and it is difficult to correctly estimate and measure the material consumed and the required makeup. Moreover, difficulty, stain and soil are associated with the handling of most bulk quantity printing substances for high speed printing.

Heretofore no fully automatic system has been developed for replenishing a printing substance for high speed printing at a rate equal to the rate of its use. Systems responsive to the rate of consumption of paper or to the output of feet or sheets of paper are unsatisfactory, since the amounts of printing vary from page to page. Time related systems are insufficient because the amount of printing varies over increments of time. Supply level or weight related systems are not useful, because the systems are slow to react, and often the printing substance is spread over an area which makes measurement of the supply impossible.

In many machines the printing substance is a developer or toner which is mixed with a carrier. The toner is consumed, but the carrier is not. Since the carrier constitutes the greater mass of the two components, and since the two are mixed, it is extremely difficult to measure variations in toner level or weight.

In one example of a high speed xerographic printing process, a printing substance or toner in powdered form is mixed with a carrier such as small glass beads, metal salts, or similar non-reacting materials. The toner might also be dispersed in a liquid. Since the toner is depleted from the supply while the carrier remains and is reused, it is necessary to accurately replenish the toner at sufficiently short intervals to insure that the ratio of toner and carrier remains substantially constant.

Systems which continuously replenish a printing substance while a machine is running or printing cannot keep a supply level constant, because consumption varies. Such a continuous replenishing system is discussed in U.S. Pat. No. 3,013,703, issued Dec. 19, 1961, and entitled "Powder Dispensing Apparatus".

Many printing devices, including computer print-out devices, employ non-impact methods of printing, such as electrophotographic or electrostatic techniques. Developing toners are used to render latent images visible. A problem has existed in replenishing the toner at a rate equal to the rate at which toner is depleted while printing. No automatic solution is known because toner is consumed at a high rate, resulting from the high rate of printing, and because a sensitive balance is required between toner and carrier. The variation in the amount of printing from page to page makes paper use an undependable indication of toner use.

A successful method of toner control must be sensitive to printing density variation since the toner consumption rate is not constant. This invention assures that toner is added only when it is needed and in amounts that are directly related to the amount of characters being printed. The present system under certain circumstances can anticipate the amount of toner required.

Electrical or electronic signals normally are associated with non-impact methods of computer printing. The signals may have varied functions; they may activate a trigger to a light source such as a flash lamp; they may terminate cathode ray tube generation of characters; or they may deliver a high voltage pulse to a shaped electrode as in electrostatic printing. All methods produce latent images of characters which must be developed in order to be visible.

Although not limited thereto, the process and apparatus described herein have useful application to electrophotographic and electrostatic printing techniques and apparatus which require developer or toner to render latent images visible. As an example, a combination in which the replenishment control described herein is useful is a cathode ray tube character generator operating with a xerographic printer, as for example, a printer described in U.S. Pat. No. 3,062,536. In a cathode ray tube character generator such as shown in U.S. Pat. No. 3,067,407, a character print signal might be taken from the unblank control trigger 28. In the cathode ray tube generator discussed in U.S. Pat. No. 3,305,841 a character signal could be taken from any stage of the SRC illustrated in FIG. 10. In a mask and flash lamp generator as set forth in U.S. Pat. No. 2,769,379, the activating means for a printing light would produce a usable character signal. Character print signals are available from many places and many systems; as an example, text organizing systems in printing machines have useful inputs to the developer control system of the present invention.

As disclosed in this invention, an electrical or electronic signal associated with each character segment, character or group of characters, hereinafter referred to as a character signal, is counted with suitable trigger circuits until a count of x number is reached. A signal representing x is sent to a driver which operates a suitable electromechanical device, which in turn releases to a developing unit of a high speed printer a measured amount of toner corresponding to the amount required to print the characters. The value of x may be a predetermined number which is associated with a measurable amount of toner. It is usually desirable that x be sufficiently low to keep the counter simple and to keep the developer mixture substantially constant. However, too low a value of x would require rapid response of the electromechanical device which releases the toner and might necessitate a faster counter reset time. The value of x is also a function of the information represented by a character signal. If the signal represents a complete character, the value of x necessary to activate the toner dispenser will be substantially smaller than if each character signal represents only a single segment of a multi-segment character.

This invention has as an objective the provision of a method to control the supply of a printing substance in response to a count of the number of characters printed or to be printed.

Another objective of this invention is the provision of a method of controlling the supply of a printing substance to a high speed electrophotographic apparatus comprising the steps of counting a number of character signals, creating a keying signal in response to the counting of a number of character signals, resetting a counter in response to the keying signal, operating a relay in response to the keying signal, actuating a metering device upon operation of the relay, and depositing an amount of printing substance from a container, into the high speed printing apparatus.

This invention has as a further objective the provision of electromechanical apparatus including a counter, a driver, resetting means, actuating means, storage means and metering means for repeatedly releasing measured amounts of a printing substance to high speed printing apparatus.

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

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a chart of the steps of a toner control method;

FIG. 2 is a schematic representation of toner control apparatus;

FIG. 3 is a schematic representation of toner control apparatus of this invention combined with conventional high speed printing apparatus.

DETAILED DESCRIPTION

Referring to the drawings, FIG. 1 illustrates a method of this invention for replenishing toner in high speed printing apparatus. Character segments, characters or character groups or lines are counted in the first step 12. When a specific number of segments, characters, groups or lines has been experienced, a driver is triggered in the second step 13. The driver resets 14 the counter and closes 15 a relay. Closing 15 the relay circuit, completes 16 a circuit to an actuator which operates 17 a metering device and dispenses 18 toner to a conventional toner distributor.

A schematic representation of the apparatus of this invention, generally indicated by numeral 20, appears in FIG. 2. Character signal 21 in FIG. 2 is some form of electrical energy which is related to electrophotographic or electrostatic printing of character segments, characters, or groups or lines of characters as sensed in a high speed printing machine. Individual character signals 21 are counted by counter 22, which, upon experiencing a preset number of signals, delivers a keying signal 23 to driver 24. Driver 24 then resets counter 22 through linkage 25. Driver 24 also operates relay 26, which closes a circuit in actuator 27. Through mechanical linkage 28, actuator 27 opens metering device 29, allowing a predetermined amount of toner to fall from container 38.

Similar apparatus is shown in FIG. 3, in which the components of the apparatus 20 are schematically shown in relationship to basic parts of a high speed printing machine 30. Printing control circuits schematically include character generating apparatus and circuits. Character print signals of printing control circuits 32 are sensed by counter 22. Printing apparatus 34 is charged to hold toner in a pattern to be reproduced. Toner distributor 36 spreads toner uniformly over printing apparatus 34. Toner container 38 is positioned above distributor 36 for supplying predetermined quantities of toner to distributor 36 upon operation of toner control system 20.

When a given number of character signals has been sensed by counter 22, driver 24 is keyed, and counter 22 is reset. Relay 26 then supplies operational current to solenoid 27, which pushes linkage 28 to the left against spring pressure; and metering dispenser 29 drops a predetermined amount of toner into distributor 36. The apparatus continues unattended

insuring a substantially uniform supply of toner in distributor.

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 various changes in form and details may be made therein without departing from the spirit and scope of the invention.

I claim:

1. The process for controlling the supply of a substance to a distributor which distributes the substance on a printing surface, the controlling being in response to electric character signals related to creation of images to be treated with the substance comprising:

sensing electric character signals related to creation of images to be treated with the substance on the printing surface;

accumulating an amount of the electric character signals so sensed;

creating a keying signal when a predetermined amount of electric character signals has been accumulated; and

actuating a metering device in response to the keying signal, and supplying a predetermined amount of substance from a container communicant with the metering device to the distributor, in response to the accumulating of a predetermined amount of electric character signals.

2. The process of claim 1 wherein the accumulating step comprises counting of electric character signals, and wherein the keying signal is created when a predetermined number of electric character signals have been counted.

3. The process for controlling the supply of a printing substance to a distributor which distributes the printing substance on a printing surface, the controlling being in response to electric signals related to characters to be printed by the surface comprising:

sensing electric printing signals corresponding to the creation of latent image items on the printing surface;

accumulating the electric printing signals which are sensed;

creating a keying signal when a predetermined amount of electric printing signals has been accumulated; and

actuating a dispensing device in response to the keying signal, and supplying a predetermined amount of printing substance from a container communicant with the dispensing device to the distributor, in response to the accumulating of a predetermined amount of electric printing signals.

4. The process of claim 3 wherein the printing substance is toner, and wherein the distributor distributes the toner over the printing surface which is selectively charged to hold toner in a predetermined pattern to be reproduced.