(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: 0 004 573
A1

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: 79100715.6

(22) Date of filing: 09.03.79

(51) Int. Cl.[2]: G 03 G 15/00

(30) Priority: 10.04.78 US 894956
10.04.78 US 894955
10.04.78 US 894957

(43) Date of publication of application:
17.10.79 Bulletin 79/21

(84) Designated Contracting States:
BE CH DE FR GB IT NL SE

(71) Applicant: International Business Machines Corporation

Armonk, N.Y. 10504(US)

(72) Inventor: Wilson, Clement Card
102 Pine Brook Hills
Boulder Colorado 80302(US)

(72) Inventor: Van Cleave, George William
7194 Rustic Trail
Boulder Colorado 80301(US)

(72) Inventor: Ernst, Larry Mason
5000 Butte No.35
Boulder Colorado 80301(US)

(72) Inventor: Seigal, Steven David
535 Brook
Boulder Colorado 80302(US)

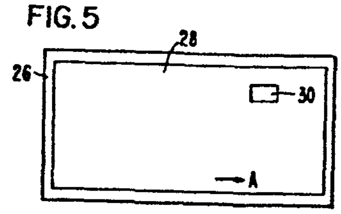
(72) Inventor: Champion, James Robert
8060 Niwot Road Apt.44
Longmont Colorado 80501(US)

(74) Representative: Hawkins, Anthony George Frederick
IBM United Kingdom Patent Operations Hursley Park
Winchester Hants S021 2JN(GB)

(54) **Xerographic copier.**

(57) In a test cycle, either at the end of a short copy production run or during an interruption in a longer copy production run, a xerographic copier is arranged to produce a toned test patch (30) in an otherwise cleaned imaging area (28) of the photoconductor (26). The optical density of both the cleaned and test areas are sensed by an electro-optic system to provide output signals indicating the respective densities. These signals are compared in a control circuit primarily to provide output signals indicating requirement for replenishment of the developer mix with toner.

FIG. 5



EP 0 004 573 A1

Croydon Printing Company Ltd.

0004573

XEROGRAPHIC COPIER

This invention relates to xerographic machines.

In document copier machines of the xerographic type, charged latent images are produced on a photoreceptive material and then developed through the application of a developer mix. Where the photoreceptive material is separate from the copy paper itself, a transfer of the developed image to the copy paper takes place with subsequent fusing of the developed image to the paper. A common type of developer mix currently in use in such machines is comprised of a carrier material, such as a magnetic bead, coated with a coloured powdery substance called toner. It is the toner which is attracted to the charged, latent image to develop that image and it is the toner which is then transferred from the latent image to the copy paper (where the copy paper is separate from the photoreceptive material). Finally, it is the toner which is then fused to the copy paper to produce the finished copy.

It is apparent from the procedure outlined above that toner is a supply item which must be periodically replenished in the developer mix since the toner is carried out of the machine on the copy paper as a reproduced image. It is also apparent that the concentration of toner particles in the developer mix is significant to good development of the latent image since too light a toner concentration will result in too light a developed image and too heavy a toner concentration will result in too dark a developed image.

Other variables which seriously affect copy quality include the image voltage of the photoconductor and the bias voltage on the developer. Many other variables factor into these basic quantities, for example, the quality of the original, the cleanliness of the optical system, and the condition of the photoconductor.

The prior art includes U.S. Patents 2,956,487 and 3,348,522. U.S. Patent 2,956,487 provides a toner concentration control system where the reflectivity of the document image to be reproduced is used as a measure of toner density. This system appears subject to difficulty since reflectivity readings will change dependent upon the quality of the original. U.S. Patent 3,348,522 discloses a toner concentration control scheme in which a special test image is developed outside the image area used for reproducing document copies. In this latter patent separate reflectivity-sensing devices are used to simultaneously sense light reflected from a single light source, one sensing device to establish a voltage indicative of clear photoconductor outside the image area and the other to establish a voltage indicative of the test area which, as noted above, is also outside the image area. U.S. Patent 3,348,523 is essentially similar to U.S. Patent 3,348,522.

U.S. Patent 3,926,338 discloses a circuit for use in a toner concentration control scheme. In this patent thermally insensitive photodetectors must be used since the large amount of heat generated during machine operation affects the accuracy of toner concentration control readings. Similarly, this patent says that a stable amplifying circuit, stable referring to temperature stability, must be used in order to avoid destruction of the validity of the sensed signal.

According to the present invention, there is provided a xerographic copier characterised by means for producing on a photoconductive imaging surface a substantially uniformly toned test area bordered by a substantially untoned area, sensing means for sensing the optical density of said areas to produce first and second sensor signals representing respectively the density of said untoned and toned areas, and control means responsive to said first and second sensor signals to provide output signals whenever the first and second sensor signals differ by more than a predetermined amount.

By way of example, an embodiment of the invention will now be described with reference to the drawings, in which:-

FIGURE 1 is a schematic layout of a xerographic machine in which the present invention may be embodied;

FIGURE 2 shows the optical system and a photoconductive drum in the machine of FIGURE 1;

FIGURE 3 is an idealized perspective view of components in the paper path of the machine;

FIGURE 4 shows the reflectivity-sensing elements of the toner concentration control device;

FIGURE 5 shows the layout of the photoconductor with the location of the bare reference area and the developed test area within the document reproduction image area;

FIGURE 6 shows the circuit for processing the reference and test information; and

FIGURE 7 shows the layout of the photoconductor for minimizing the need for special cycles in long, multi-copy runs.

FIGURE 1 shows a typical electrophotographic machine of the transfer type. Copy paper is fed from either paper bin 10 or paper bin 11 along guides 12 in the paper path to a transfer station 13A located just above transfer corona 13. At that station an image is placed upon the copy paper. The copy paper continues through the fusing rolls 15 and 16 where the image is firmly attached to the copy paper. The paper continues along path 17 into a movable deflector 18 and from there into one of the collator bins 19.

In order to produce an image on the photoconductive surface 26, an image of a document to be copied is transferred to the photoconductive surface 26 through an optics module 25 producing that image on the photoconductive surface 26 at exposure station 27. As the drum 20 continues to rotate in the direction A, developer 23 develops the image which is then transferred to the copy paper. As the photoconductor continues to rotate it comes under the influence of preclean corona 22 and erase lamp 24 which discharge all of the remaining charged areas on the photoconductor. The photoconductor continues to pass around and through the developing station 23 (which is also a cleaning station in this embodiment) until it reaches the charge corona 21 where the photoconductor 26 is again charged prior to receiving another image at exposure station 27.

FIGURE 2 is a perspective view of the optics system showing the document glass 50 upon which a document to be copied is placed. An illumination lamp 40 is housed in a reflector 41. Sample light rays 42 and 43 emanate from lamp 40 and are directed from dichroic mirror 44 to the document glass 50 whereat a line of light 45 is produced. Sample light rays 42 and 43 are reflected from the document placed on the document glass to reflective surface 46; from there to reflective surface 47 to reflective surface 48 and thence through lens 9 to another reflective surface 49. From mirror 49 the light rays are finally reflected through opening 51 in wall 52 to reach photoconductor 26 whereat a line of light 45' is produced. In that manner a replica of the information contained in the line of light 45 on the glass platen 50 is produced on the photoconductor 26 at 45'. The entire length of a document placed on document glass 50 is scanned by motion of lamp 40 and the mirrors 44, 46, 47 and 48. By traversing the line of light 45 across the document at the same speed at which the line of light 45' is moved across photoconductor 26 by rotation of drum 20, a 1:1 copy of the document can be produced on the photoconductor 26.

FIGURE 3 shows the various elements in the paper path in perspective. Here a copy sheet 31 is shown with its trailing edge 31A in the paper path at guides 12. The copy paper is receiving an image at transfer station 13A and is in the process of having that image fused to itself by fuser rolls 15 and 16. The leading edge 31B of the copy paper is about to leave the document copier and proceed into the collator 19 which is represented in simplified form.

After an image is transferred to the copy paper, the photoconductor 26 continues to rotate until it comes under the influence of preclean corona 22 which applies a charge to the photoconductive surface to neutralize the remaining charge thereon. Photoconductor 26 continues to rotate until the photoconductor comes under the influence of an erase light 24' in housing 24. The erase light produces illumination across the entirety of the photoconductor 26 in order to complete the discharge of any remaining areas on the photoconductive surface which have not been neutralized by the preclean corona 22. After passing under erase lamp 24', the photoconductor continues through the cleaning station of developer/cleaner 23, wherein any remaining toner powder not transferred to copy paper is cleaned from the photoconductor prior to the beginning of the next copy cycle.

In the next copy cycle the charge corona 21 lays down a uniform charge across photoconductor 26 which charge is variably removed when the image of the document is placed on the photoconductor at the exposure station 27 shown in FIGURE 1. Preclean corona 32 and erase lamp 24' are off during this cycle.

When the toner concentration control cycle is run, and if the result indicates a need to add toner to the developer, a signal is sent to replenisher 35 which holds a supply of toner and operates to dump a measured amount into the developer. In that manner, the toner density of the developer mix is replenished. Any suitable replenisher mechanism may be used including the replenisher described in IBM Technical Disclosure Bulletin, Vol. 17, No. 12, pp. 3516, 3517.

FIGURE 3 shows a housing 32 containing the toner concentration control sensing system shown in FIGURES 4 and 6. When it is desired to sense for the concentration of toner in the developer mix the photoconductor is charged as usual at the charge corona 21, but no image is placed on the charged photoconductor at exposure station 27. Instead, on this cycle, the erase lamp 24' remains on, discharging all of the charge which has been laid down by charge corona 21 in order to provide bare photoconductor for a reference test area. However, the erase lamp 24' is momentarily interrupted to produce a charged stripe toned sample for a test area. If the lamp 24' is comprised of an array of light-emitting diodes, the array can be segmented such that only a few of the LEDs are momentarily turned off and therefore only a small "patch" of charge remains on the photoconductor at the conclusion of this part of the cycle. If a fluorescent tube is used as the erase lamp 24', momentarily reducing its energization to a low level will produce a "stripe" of charge remaining on the photoconductor at the conclusion of this part of the cycle.

Whether a stripe of charge or a patch of charge is produced, the charged test area continues to rotate in the direction A until it reaches the developer 23 where toner is placed onto the charged area to produce a toned sample test area. No copy paper need be present at transfer station 13A in the test cycle, thus allowing the developed test area to continue its rotation in direction A until it approaches the toner concentration control housing 32. At this point, referring now to FIGURE 4, a light-emitting diode (LED) or other suitable light source 33 is energized to produce light rays which reflect off the toned sample test area 35 and are reflected to a photosensor 34. It should be noted that the toned image could be transferred to copy paper, if desired. The reflectance of the developed and transferred stripe (or patch) would then be sensed by locating sensors on the paper path. It should also be noted that the principles of this system work well with photosensitive paper, i.e., electrophotographic machines in which the image is exposed directly onto the copy paper rather than through a transfer station.

FIGURE 5 shows the layout of the photoconductor 26 with an image area 28 outlined therein. A developed patch 30 has been produced within the image area 28. FIGURE 2 shows apparatus for producing patch 30. As described above, erase lamp 24' is momentarily interrupted to produce a stripe of charge. While the above description designated 45' as a line of light producing an image on photoconductor 26, suppose now that during the test cycle the line or stripe 45' is used to designate a stripe of charge produced by momentarily interrupting lamp 24'. Suppose also that document lamp 40 is turned on during the test cycle so that light from lamp 40 will erase the stripe of charge 45' unless it is interrupted. Such an interruption is made possible by the provision of shutter 36 which is shown in FIGURE 2 as dropping across slot 51 in wall 52. Shutter 36 is actuated by solenoid 38. As a result, light from lamp 40 is blocked away from photoconductor 26 by shutter 36, thus producing a stripe of charge 37. Of course, erase lamp 24' will erase all of stripe 37 except for patch 30. In that manner, a patch instead of a stripe can be produced. Note that slot 51 should be positioned close to the photoconductive surface 26.

As FIGURE 5 demonstrates, placing the test area 30 within image area 28 necessitates skipping the production of a copy during a long, multi-copy run since a density test should be taken periodically, for example, after 20 copies. On short runs the test is taken on the run-out cycle at the conclusion of document reproduction. FIGURE 7 shows the layout of photoconductor 26 illustrating a technique for avoiding the need for skipping copies even when operating a long, multi-copy run. If the machine has the capability of producing two different size copies, for example, 216 x 280 m.m. and 216 x 355 m.m. the extra 3-inch part of the image area 28 can be used for the density test without skipping a copy. FIGURE 7 shows the timing considerations needed for the erase lamp, the document lamp, and the shutter 36 of FIGURE 2.

If a segmented LED array is used for the erase lamp, or if a stripe of charge is produced instead of a patch 30, the production of the test area is obtained by turning off the document lamp at the conclusion of viewing the 11-inch document and momentarily interrupting the erase lamp as shown on FIGURE 7. Of course, no shutter is used in that case.

In order to produce a reference voltage, when the proper time in the sequential operation of the machine has arrived, the logic control of the machine provides a signal to trigger the viewing of a reference sample. This is accomplished by energizing LED 33 in the following manner. The logic signal results in triggering a transistor switch (not shown) which connects the reference sample input line 60 to ground. As a consequence, the voltage on the negative input of OP

AMP 61 is dropped from approximately 8 volts to about ground potential. This causes the negative input of OP AMP 61 to switch from a value higher than the positive input to one that is lower resulting in an inversion of OP AMP output from low to high on line 62. That output is then fed back to the positive input to lock the OP AMP 61 in a high output condition avoiding oscillations. The output voltage on line 62 is applied to transistor Q2 to turn that transistor on, thus closing a circuit from the 24-volt source through the light-emitting diode 33 and transistor Q2 to ground. The result is to provide light from the LED 33 to the photocell 34 at the precise time in the machine cycle to reflect light rays from the bare photoconductor to photocell 34.

In order to produce a sensed toned sample voltage, when the proper time in the machine cycle is reached to direct light upon the toned sample a logic signal is provided to turn on a transistor switch, not shown, to connect the toned sample input line to ground. This results in lowering the negative input on OP AMP 63 from approximately 8 volts to ground potential and causes the output on line 64 to go high. The signal on line 64 turns on the transistor Q1, causing the light-emitting diode to conduct through the transistor Q1 to ground. Note that the resistance levels connected with the transistor Q1 are significantly lower than the resistances associated with transistor Q2. As a result, the current level through transistor Q1 is significantly higher than the current level through Q2, thus creating a more intense light from LED 33 when the toned sample is viewed. The reason for this is that the bare photoconductor will reflect a higher light level than the toned photoconductor. It was recognized that the reflected light intensities exciting the photocell must be kept at a nearly equal level whether viewing a bare sample or a toned sample. The reason for this is to avoid the non-linearities which occur in photocell excitations from reception of different light levels to avoid the non-linearities in circuit response and to guarantee high signal levels whether viewing the bright reference sample or the dark toned sample in order to improve noise immunity. In a system which is designed to be relatively free from variations in component sensitivities, this is an important feature.

Referring now to the circuit of photocell 34, note that OP AMP 65 is connected as a transconductance amplifier. With photocell 34 off only a small dark current flow exists between the output of OP AMP 65 and the negative input. However, when the photocell is excited, the current flow is substantially increased causing a significant voltage drop across resistors R16 and R17 creating a voltage level at line 66 of perhaps 1 or 2 volts. Zener diode 67 limits the voltage level which can occur at line 66 to 8.5 volts, i.e., a swing of 8.5 volts from the photocell unexcited value. Assuming a photocell excited voltage level of 2 volts at line 66, the change from 0 volts to 2 volts is coupled through capacitor 68 to an integrating circuit comprised of OP AMP 69, capacitor 70, field effect transistor (FET) Q5 and the associated resistances. Under ordinary conditions 16 volts is placed on the input of OP AMP 69 resulting in an output of 16 volts at line 71. When a light source excites the photocell, resulting in a voltage of, for example, 2 volts on line 66, a two-volt swing appears across the capacitor 68 and is placed on the capacitor 70, resulting in a ramping down of the voltage on line 71 from 16 volts to 14 volts. If a bare (reference) sample is being taken the output of OP AMP 61 biases diode 72 to turn on FET Q6 during the bare sample period. Thus the 14 volts on line 71 passes through FET Q6 and is placed on capacitor 73. That voltage is stored until such time as the toned sample is taken by photocell 34.

When the toned sample is taken, there should again be a 2-volt potential produced on line 66 if the density of the toned sample is approximately correct. This is true because of the balancing of current flow in photocell 34 regardless of whether a reference sample or a toned sample is being taken (due to the different current levels through LED 33 as explained above). Thus a 2-volt swing again appears across capacitor 68 resulting in a 2-volt potential drop across capacitor 70, causing the voltage of line 71 to ramp down from 16 to 14 volts. During the toned sample input period FET Q7 is turned on and FET Q6 remains off. Thus the 14 volts present on capacitor 73, that is, the reference voltage, is placed on the positive inputs of OP AMPS 74 and 75, while the toned sample input present on line 71 is connected directly to the negative input of OP AMP 74, and is connected through a voltage divider network to the negative input of OP AMP 75. If, for example, resistance levels R21 and R22 were equal, the potential at the negative input of OP AMP 75 would be the difference of 14 volts on line 71 and the 16 volts input, that is, 15 volts.

At OP AMP 74, the 14-volt reference signal is placed on the positive input while the 14-volt toned sample signal is placed on the negative input. Since there is no differential, the output of OP AMP 74 indicates that the toner concentration condition is correct and the toner low signal remains off. Similarly, at OP AMP 75, the bare sample input is 14 volts, the toned sample input is 15 volts, and therefore the toner extra low signal remains off.

Suppose, however, that the toner density of the toned patch was too light. The result would be an excessive reflection of light from that patch, causing a high excitation of photocell 34 and resulting in a potential at line 66 of, for example, 4 volts. In this example a 4-volt swing would appear across capacitor 68, thus causing a ramping of the voltage at line 71 from 16 volts to 12 volts. Now the 12 volts appears directly on the negative input of OP AMP 74 and is compared to the 14 volts on the positive input, creating a high output, thus turning on the "toner low" signal. OP AMP 16 is designed to register when a 30 millivolt difference appears, and thus the low output signal will now be energized. At OP AMP 75, the toned sample signal of 12 volts on line 71 is divided against 16 volts and if the resistances R21 and R22 were equal, would cause 14 volts to appear at the negative input of OP AMP 75. Since both inputs are 14 volts, the toner extra low signal remains off.

Suppose now that the toned sample was so light that the photocell excited to such a degree that a 6-volt swing was experienced on line 66, thus sending the voltage on line 66 from 0 volts to 6 volts. That 6-volt swing causes a ramping of the voltage on line 71 from 16 volts to 10 volts. When the 10 volts is divided with the 16 volts (again assuming equal R21 and R22 values) a voltage of 13 volts is placed on the negative input of OP AMP 75. When this 13-volt signal is compared to the 14-volt reference, the toner extra low output signal is turned on.

During regular operation of the machine, i.e., when there is no interruption for a test cycle, it is desirable to provide a checking signal in order to determine that the test network is in operating order. That is provided by the portion of the circuit including transistor Q8. Note that when transistor Q8 is turned on the negative input to OP AMP 75 is grounded and thus turns high the output of OP AMP 75. As a consequence, the toner extra low signal is turned on. At the same time the voltage levels at OP AMP 74 keep the toner low output signal off. This creates an unusual condition of having the toner extra low signal on while the toner low signal is off. This condition is forced by the operation of transistor Q8, and thus any change in this condition during the operation of the machine will signify to the machine logic that something is wrong in the test circuit. Note that transistor Q8 is turned on by a high output from OP AMP 76. A high output from OP AMP 76 is present whenever the output of OP AMP 77 is high (neglecting the RC time delay). OP AMP 77 is high when the negative input is lower than the input on the positive side. Note that since line 66 is at 0 volts during regular operation, the voltage at the negative input of OP AMP 77 is lower than the positive side under normal conditions. Note, however, that when a bare or toned sample is taken, voltage on line 66 rises, thus turning off the high output from OP AMP 77, turning off the high output from OP AMP 76 and thus opening the circuit of transistor Q8.

Another quality test available through this circuit is that if the photoconductor has become so coated with toner that when the bare sample is taken it actually is a darkened sample, there will be only a small amount of light from LED 33 appearing at the photocell 34. It will be a much lower photocell excitation than expected, consequently, the voltage on line 66 does not change significantly, and thus even though a bare sample is being taken, transistor Q8 is not turned off since line 66 does not change significantly higher from its regular value. Therefore the output of OP AMP 77 remains high and transistor Q8 remains on. In this situation, the logic senses the fact that the toner extra low output signal from OP AMP 75 has remained on even though it should have gone off when entering the test sequence. This informs the logic that a darkened photoconductor condition is present and that remedial steps are needed. Consequently, the circuit of transistor Q8 performs a darkened photoconductor check as well as indicating the presence of problems in the test circuit itself.

Upon testing for toner density, if the toner low signal is activated, the toner replenisher 35 (FIGURE 3) operates to dump a quantity of toner into developer 23. If both the toner low and the toner extra low signals are activated, a variety of possibilities for further action are present, depending on machine design. For example, the first subsequent action would probably be to check a "cartridge empty" signal from the toner replenisher 35. If it is empty, a call for the key operator of the machine is in order. However, if the replenisher has an adequate toner supply, the next action might be to shut the machine down. Alternatively, there might be repeated toner density checks after a few more copies until the toner extra low signal is no longer active. At some point, if the extra low signal remains activated, the machine would be shut down.

As stated above, a test cycle can be run on the shut-down cycle when only small numbers of reproductions are called for during a reproduction run. Special test cycles with reproductions skipped may be used only during long, multi-copy runs. Providing the specific control circuitry for interrupting machine operation to provide special test cycles at the proper time is dependent upon the requirements of a particular machine. Such circuit design is well within the skill of the art and does not comprise a part of the instant invention. Similarly, control apparatus for receiving the toner low and toner extra low signals to actuate the replenisher are well within the skill of the art and not a part of the invention herein.

CLAIMS

1. A xerographic copier characterised by means (22, 23, 24, 25, 36) for producing on a photoconductive imaging surface (26) a substantially uniformly toned test area (30) bordered by a substantially untoned area, sensing means (32) for sensing the optical density of said areas to produce first and second sensor signals representing respectively the density of said untoned and toned areas, and control means (Figure 6) responsive to said first and second sensor signals to provide output signals whenever the first and second sensor signals differ by more than a predetermined amount.

2. A xerographic copier as claimed in claim 1, in which said photoconductive imaging surface is a re-usable surface from which toned images are transferred to copy sheets, characterised in that said test area is within the portion (28) of the imaging surface used for copy reproductions.

3. A xerographic copier as claimed in claim 2, in which said test area is formed during a test cycle in which no copy is reproduced.

4. A xerographic copier as claimed in claim 3, in which said test cycle is run upon the completion of a copy production run of less than a predetermined number of copies.

5. A xerographic copier as claimed in claim 4, in which said test cycle is run by interrupting the production of copies in a copy production run of more than said predetermined number of copies.

6. A xerographic copier as claimed in any of the previous claims, including a developer station (23) operable to direct a developer mix, comprising carrier particles and toner on to the imaging surface, and a toner replenisher device (35) operable in response to said output signals to replenish said mix with toner.

7. A xerographic copier as claimed in any of the previous claims, in which said control means is responsive to a said first sensor signal indicating an optical density of said untoned area greater than a predetermined amount to provide an output signal indicative of contamination of the imaging surface.

8. A xerographic copier as claimed in any of the previous claims in which said areas are produced by operation of a pre-clean corona (22) and selective operation of an erase lamp (24).

9. A xerographic copier as claimed in claim 8, including a shutter (36) associated with the erase lamp and effective therewith to define said test area.

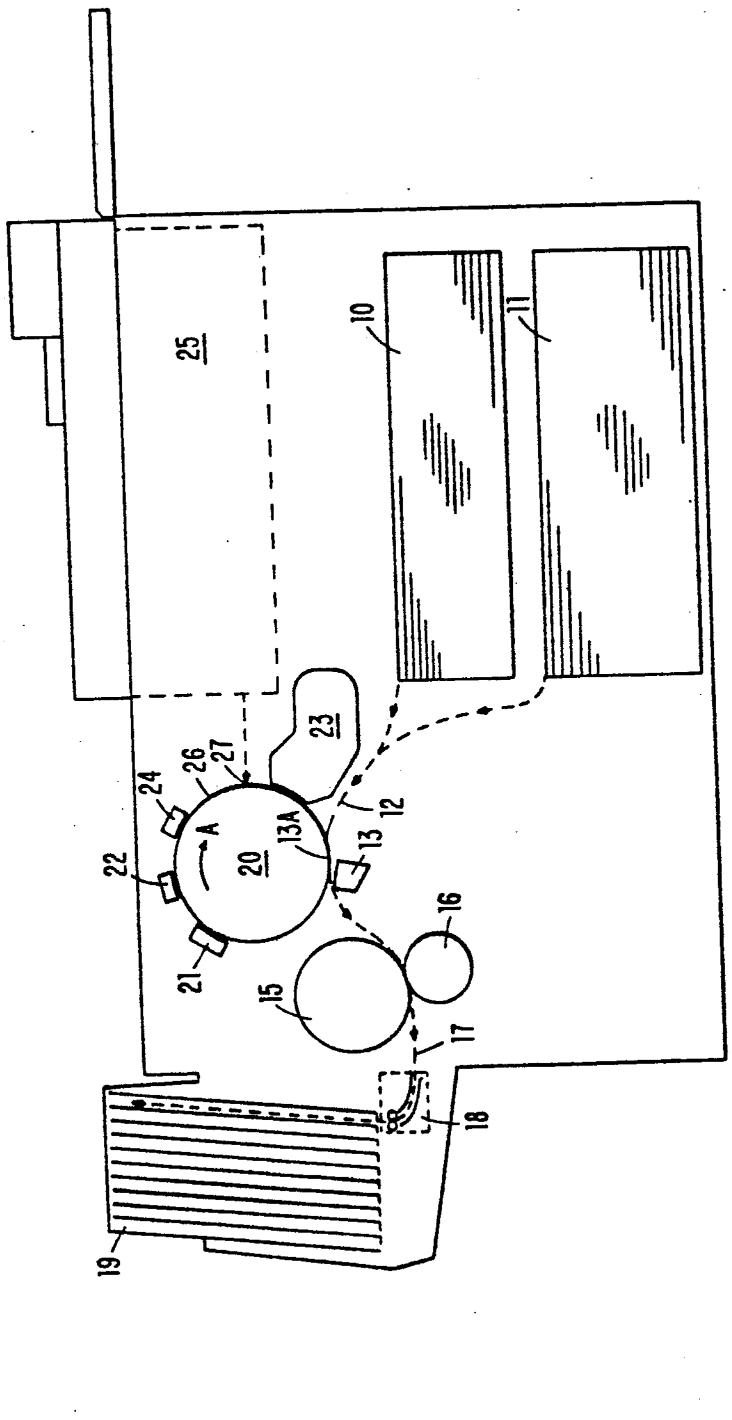


FIG.1

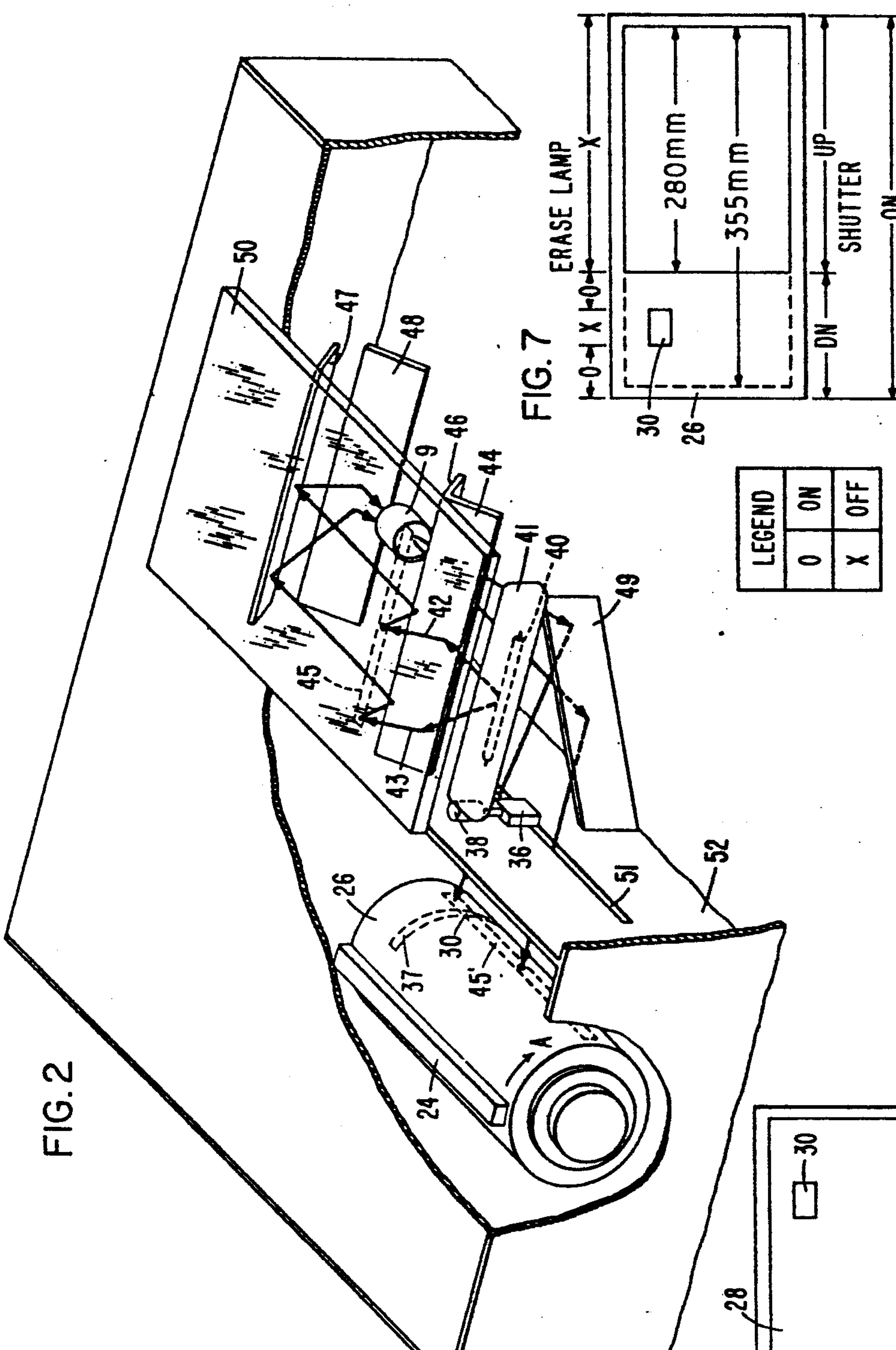


FIG.2

FIG. 7

LEGEND	
O	ON
X	OFF

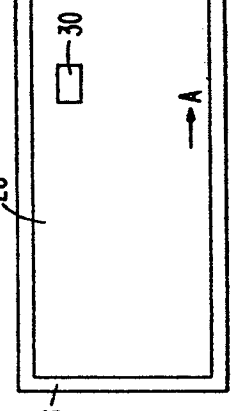
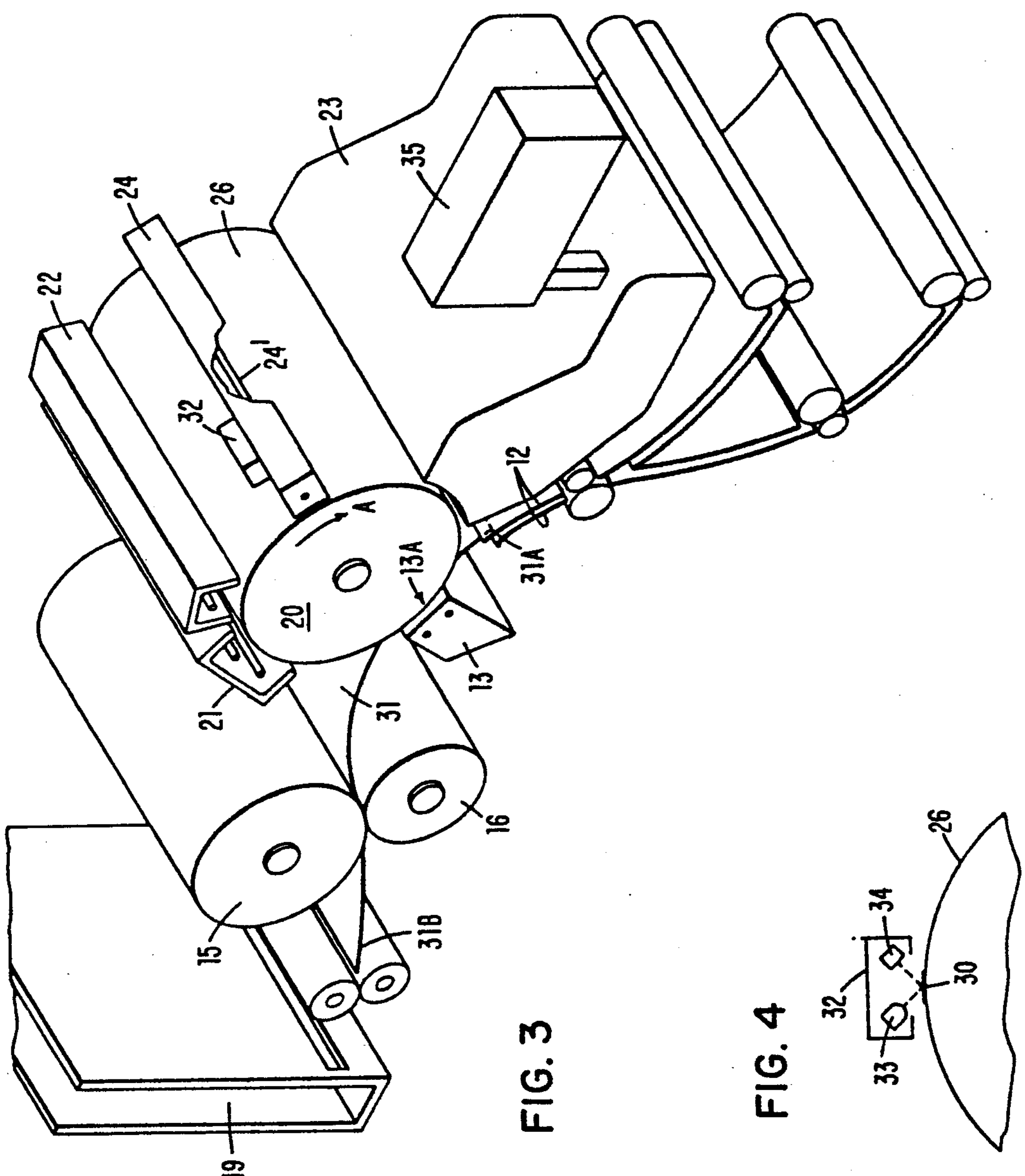


FIG.5



22
24
26
23
35
24'
32
A
12
31A
13A
20
13
21
31
16
15
31B
19

26
34
32
30
33

FIG. 3

FIG. 4

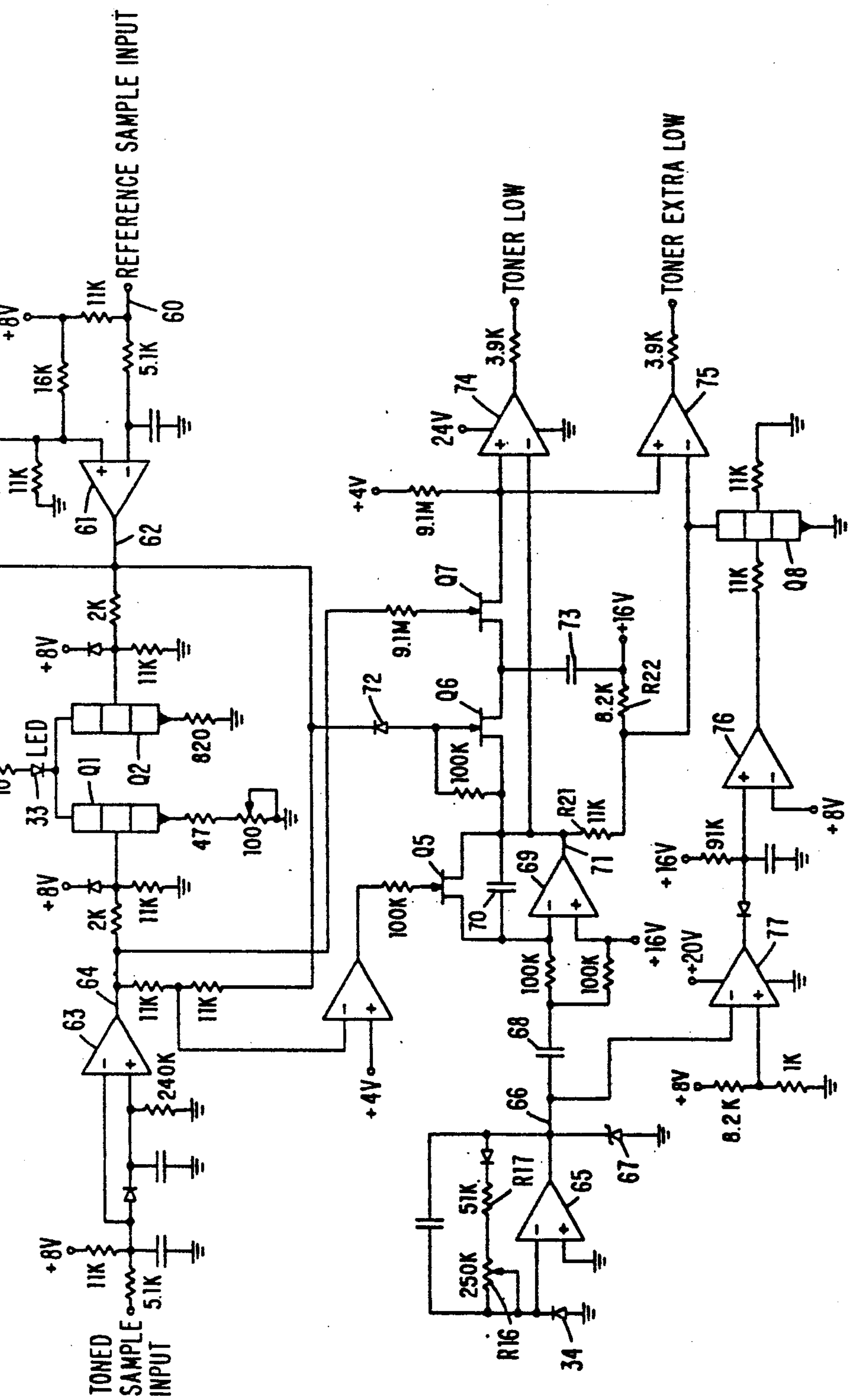

REFERENCE SAMPLE INPUT
60
+8V
11K
16K
5.1K
150K
11K
61
62
2K
+8V
11K
+24V
10
LED
33
Q1
Q2
820
47
100
+8V
2K
11K
63
64
11K
11K
240K
+8V
11K
5.1K
TONED SAMPLE INPUT
+4V
100K
Q5
70
69
71
R21
11K
100K
100K
+16V
68
66
67
65
R17
51K
250K
R16
34
72
Q6
100K
Q7
9.1M
73
+16V
8.2K
R22
+4V
9.1M
24V
74
3.9K
TONER LOW
3.9K
TONER EXTRA LOW
75
11K
11K
Q8
76
+8V
+16V
91K
+20V
77
+8V
8.2K
1K

FIG. 6

°°4573

European Patent Office

EUROPEAN SEARCH REPORT

Application number
EP 79 10 0715

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
	US - A - 4 082 445 (E.L. STEINER) * Column 4, lines 37-52; figure 2 *	1,2,6
	US - A - 3 969 114 (D.J. PRATS) * Column 1, lines 27-38; column 3, lines 41-50 *	1,6
D	US - A - 3 348 522 (J.M. DONOHUE) * Column 6, lines 26-33; figure 9 *	1,6
D	US - A - 3 348 523 (J.R. DAVIDSON et al.) * Column 5, lines 22-34; figure 4 *	1,6
E	DE - A - 2 756 291 (XEROX CORP.) * Claims; page 7, 2nd paragraph *	1

CLASSIFICATION OF THE APPLICATION (Int. Cl.²)

G 03 G 15/00

TECHNICAL FIELDS SEARCHED (Int.Cl.²)

G 03 G 15/00
15/052
15/06
15/08

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	15-05-1979	HILTNER

EPO Form 1503.1 06.78