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

(11) Publication number: **0 109 722**
A1

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: **83201650.5**

(22) Date of filing: **18.11.83**

(51) Int. Cl.³: **G 03 G 15/02**
G 03 G 21/00

(30) Priority: **19.11.82 NL 8204520**

(43) Date of publication of application:
30.05.84 Bulletin 84/22

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

(71) Applicant: **N.V. Nederlandsche Apparatenfabriek NEDAP**
Oude Winterswijkseweg 7
NL-7141 DE Groenlo(NL)

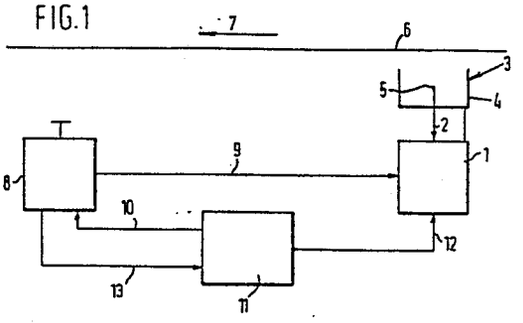
(72) Inventor: **Hoeksma, Gerben Simon**
Bargerkempke 5
NL-7103 DX Winterswijk(NL)

(74) Representative: **Urbanus, Henricus Maria, ir. et al,**
c/o Vereenigde Octrooibureaux Nieuwe Parklaan 107
NL-2587 BP 's-Gravenhage(NL)

(54) **A method and an apparatus for automatically adjusting the potential of a photosensitive layer.**

(57) A method of automatically adjusting the potential of a photosensitive layer, in which the photosensitive layer is moved along a corotron energized by a high voltage supply and is charged thereby, in which the potential of a corotron-charged portion of the photosensitive layer is measured contactlessly by means of an electrometer device; that the value measured is compared with a predetermined target value, after which, if the difference between the value measured and the target value lies beyond predetermined limits, an adjustment parameter of the high voltage supply is changed; and that after a period of time minimally equal to the time required for moving the portion of the photosensitive layer charged with the new setting of the high voltage supply from the corotron to the electrometer, the potential of the photosensitive layer is measured again and compared with the target value, after which, if the difference between the target value and the value measured lies beyond predetermined limits, the said adjustment parameter is again changed, which cycle is repeated as long as the difference between the target value and the value measured lies within the predetermined limits.

FIG.1



EP 0 109 722 A1

Title: A method and an apparatus for automatically adjusting the potential of a photosensitive layer.

The invention relates to a method of adjusting the potential of a photosensitive layer, in which said layer is moved along a corotron energized by a high voltage supply and is charged thereby, as well as to an apparatus for applying the method.

Such a method and apparatus are applied e.g. in copying apparatus, in which, according to the known technique, the high voltage supply supplies a charging current to a corotron.

Along the corotron there is moved a photosensitive layer applied e.g. on a drum rotating in operation, said layer being charged by the corotron by means of corona discharge.

The photosensitive layer thus charged is subsequently exposed via a document to be reproduced. Since, upon exposure of the photosensitive layer, charge is leaking away in a manner corresponding to the intensity of the incident light, and therefore to the document to be reproduced, there is produced an electrostatic image pattern, which can be transferred onto an image carrier, such as paper, by any of the methods known for that purpose.

To effect that the photosensitive layer is charged uniformly, the current flowing through the corotron is stabilized.

However, it has been found that in this manner the uniformness of the charge of the photosensitive layer leaves to be desired.

Nevertheless, it is highly important for the exposure and development process following the charging of the photosensitive layer, and hence for the copying quality, that the photosensitive layer is charged as uniformly as possible.

Similar considerations apply to certain types of facsimile apparatus, in which likewise a photosensitive layer is charged, and wherein the uniformness of the charge formed is important for the quality of the image transfer.

The same applies to laser printers, wherein a photosensitive layer first charged and subsequently exposed is scanned by a laser. In such apparatus, too, a uniform charging of the photosensitive layer is highly important.

It is therefore an object of the invention to improve the uniformness of the charge formed by a corotron on a photosensitive layer.

To this end, according to the invention, a method of the above described type is characterized in that the potential of a corotron-charged portion of the photosensitive layer is measured contactlessly by means of an electrometer device; that the value measured is compared with a predetermined target value, after which, if the difference between the value measured and the target value lies beyond

predetermined limits, and adjustment parameter of the high voltage supply is changed; and that after a period of time minimally equal to the time required for moving the portion of the photosensitive layer charged with the new setting of the high voltage supply from the corotron to the electrometer, the potential of the photosensitive layer is measured again and compared with the target value, after which, if the difference between the target value and the value measured lies beyond predetermined limits, the said adjustment parameter is again changed, which cycle is repeated as long as the difference between the target value and the value measured lies within the predetermined limits.

An apparatus for applying the method is characterized, according to the invention, by an electrometer device along which the photosensitive layer, after having been charged by the corotron, is moved, which electrometer device measures contactlessly the potential of the photosensitive layer; a comparator for comparing the value measured of the potential with a predetermined target value, which comparator transmits an output signal dependent on the difference between the value measured and the target value and which is supplied to the high voltage supply in order to control an adjustment parameter of the high voltage supply.

Some embodiments of the apparatus according to the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a diagrammatic illustration of a first embodiment of an apparatus according to the invention;

Fig. 2 shows a part of the apparatus of Fig. 1 in greater detail; and

Fig. 3 shows a variant of Fig. 2.

Fig. 1 shows a high voltage supply 1 of a conventional type, the output of which is connected to a corotron 3.

The corotron 3 comprises, as is conventional, a housing 5, which is open at one end and wherein there extends a conductor 4. The open end faces the photosensitive layer 6, which can be charged by a corona discharge originating from the conductor 5.

In operation, the photosensitive layer moves along the corotron, thereby being charged along the entire surface. The direction of movement of the photosensitive layer is indicated by an arrow 7.

For obtaining a proper image transfer quality, it is highly important that the photosensitive layer is charged as uniformly as possible.

According to the invention, the photosensitive layer, after having been charged by the corotron 3, moves along an electrometer 8, by means of which the potential of the photosensitive layer is measured contactlessly.

The potential measured can then be compared with a predetermined target value and, depending on the difference between the two values, a setting signal can be supplied to the high voltage supply 1 through a line 9. This is realized in practice as follows.

After the photosensitive layer has been set in motion at the nominal speed v, and it has been communicated for instance by means of a control signal 10, originating from a machine control unit 11, to the electrometer 8 that the adjustment procedure is to be initiated, the electrometer transmits the best estimate of the required charging current to be passed through the conductor 5 to the high voltage supply 1, which is switched on e.g. through a control signal 12 originating from the control unit 11. After an interval which is minimally equal to the time required for conducting the corotron-charged portion of the photosensitive layer to the electrometer, the electrometer measures the actual potential of the photosensitive layer and again gives the best estimate for the adjustment of the high voltage supply, based on the actual value of the potential of the photosensitive layer and the estimated required change of the setting of the high voltage supply. When again some time has lapsed necessary for conducting the charged portion of the photosensitive layer from the corotron to the electrometer, the potential of the photosensitive layer is again measured and, if necessary, the high voltage supply is readjusted. When the potential has

come to be within the required tolerance band, the electrometer transmits a signal to the control unit 11 through a line 13 and the adjustment procedure can be terminated. The electrometer retains the setting value for the charging current, determined in the above described manner, and this charging current is supplied to the corotron in the next process. After some time, the adjustment procedure can be repeated.

The electrometer is preferably of the known per se type with rotary chopper blade. In a simple embodiment shown in Fig. 2, the electrometer is connected to ground and can be supplied from a d-c voltage available in the machine. A rotary chopper blade 14 periodically covers a collecting electrode 15. In non-covered condition, the potential of the photosensitive layer 16 induces charge onto the electrode 15. This alternating charge is converted by an input stage 17 with a virtual earth input into an a-c voltage which, after a possible amplification in an amplifier stage 18, is converted by a phase-responsive detector 19, into a d-c voltage. For this purpose, the phase detector 19 requires a phase signal 20 that is in synchronism with the rotary chopper 14.

The control signal 10 starts a timer 21 which transmits a signal to comparator circuitry 23 through a line 22. On the basis of the actual value 24 transmitted by the phase-responsive detector 19 and the desired value 25, said circuitry then determines the best estimate for the

new setting of the charging current of the corotron. After a given interval, not shorter than necessary for the arrival of the portion of the photosensitive layer charged with the newly adjusted charging current at the electrometer, a signal is again transmitted and the adjustment procedure is continued, as described in the above, until the potential of the photosensitive layer approximates the desired value sufficiently accurately and the electrometer communicates this to the control unit 11 e.g. by means of a signal through the line 13, after which the adjustment procedure can be terminated.

In a modified embodiment, shown in Fig. 3, the electrometer-chopper blade and the subsequent circuitry is connected to a reference voltage source 27 carrying the same voltage U_{ref} as the desired nominal value of the voltage of the photosensitive layer. This electrometer functions, for the rest, analogously to the above described electrometer and comprises an amplifier 17 with a virtual earth input, possibly an amplifier stage 18, and a phase-responsive detector 19 receiving a phase signal 20. In operation, the phase-responsive detector transmits a signal through a galvanic separation element 28, to comparator circuitry 29, which signal is proportional to the difference between the potential of the photosensitive layer 16 and the potential of the voltage source 27. The timer 21 has the same function as described in the above, and the comparator circuitry 29 generates the setting value 9 and the feedback signal 13,

as described in the above.

The advantage of this modified embodiment is that the actual potential of the photosensitive layer, after termination of the adjustment procedure, does not depend either on the distance between the photosensitive layer and the electrometer, or on the surface area of the electrode 15, or on the speed of the chopper, or on the gain factor of the electrometer-amplifier stages, so that the accuracy of the potential set is determined primarily by the accuracy of the reference voltage source, thus enabling a very simple calibration of this system, combined with a very good long-term stability thereof.

Various modifications of the above described method and apparatus will readily occur to those skilled in the art after reading the above description. For instance, it is possible to control, instead of the charging current directly supplied by the high voltage supply, a different parameter of the high voltage supply. It is also possible to obtain the time control signals from an external source. These and similar modifications are deemed to lie within the scope of the invention.

C L A I M S:

1. A method of automatically adjusting the potential of a photosensitive layer, in which the photosensitive layer is moved along a corotron energized by a high voltage supply and is charged thereby, characterized in that the potential of a corotron-charged portion of the photosensitive layer is measured contactlessly by means of an electrometer device; that the value measured is compared with a predetermined target value, after which, if the difference between the value measured and the target value lies beyond predetermined limits, an adjustment parameter of the high voltage supply is changed; and that after a period of time minimally equal to the time required for moving the portion of the photosensitive layer charged with the new setting of the high voltage supply from the corotron to the electrometer, the potential of the photosensitive layer is measured again and compared with the target value, after which, if the difference between the target value and the value measured lies beyond predetermined limits, the said adjustment parameter is again changed, which cycle is repeated as long as the difference between the target value and the value measured lies within the predetermined limits.

2. An apparatus for automatically adjusting the potential of a photosensitive layer, comprising a corotron energized by a high voltage supply, along which corotron the photosensitive layer is moved, characterized by an electrometer device along which the photosensitive layer, after

having been charged by the corotron, is moved, which electrometer device measures contactlessly the potential of the photosensitive layer; a comparator for comparing the value measured of the potential with a predetermined target value, which comparator transmits an output signal dependent on the difference between the value measured and the target value and which is supplied to the high voltage supply in order to control an adjustment parameter of the high voltage supply.

3. An apparatus according to claim 2, characterized in that the electrometer comprises an electrometer of the type with a rotary chopper blade, as well as a synchronous detector for rectifying the output signal of the electrometer in synchronism with the rotary chopper blade, while the output of the synchronous detector is connected to the input of the comparator.

4. An apparatus according to claim 3, characterized in that the chopper blade of the electrometer is connected to a reference voltage source U_{ref} supplying a voltage corresponding to the desired value of the potential of the photosensitive layer.

5. An apparatus according to any one of claims 2-4, characterized by a timer which controls the electrometer, corresponding to the speed of motion of the photosensitive layer.

FIG.1

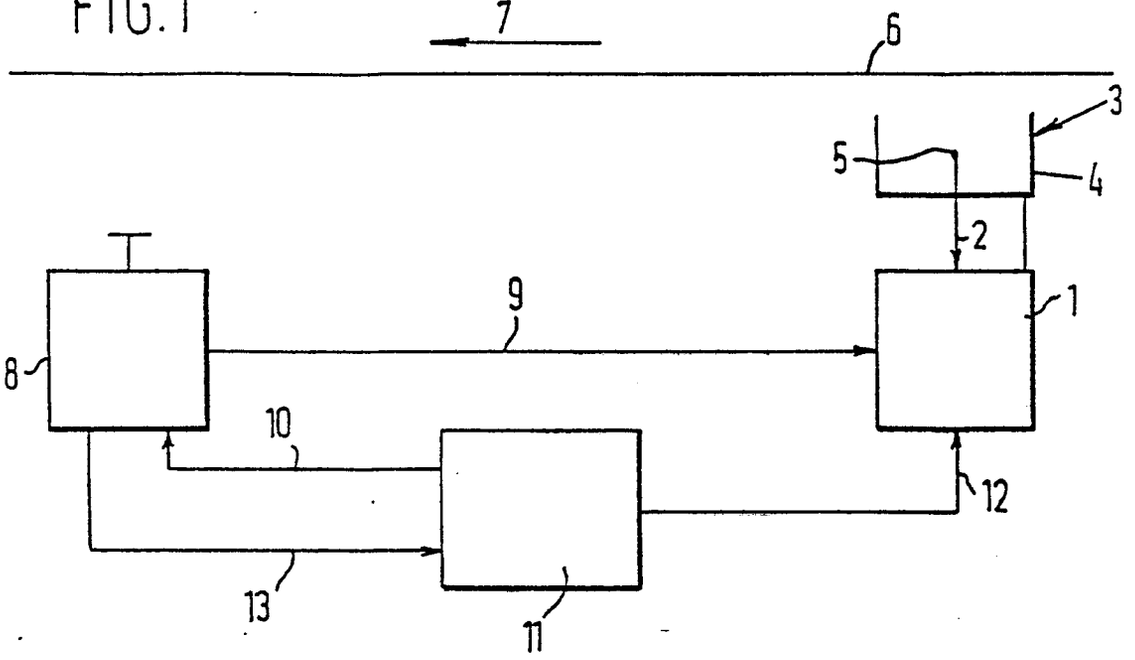


FIG.2

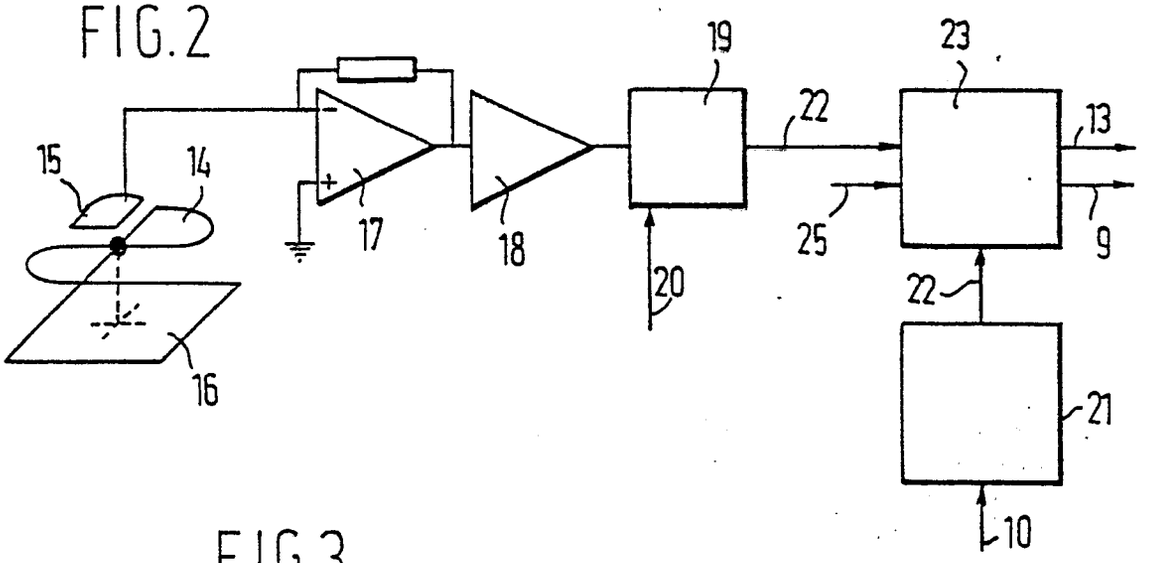
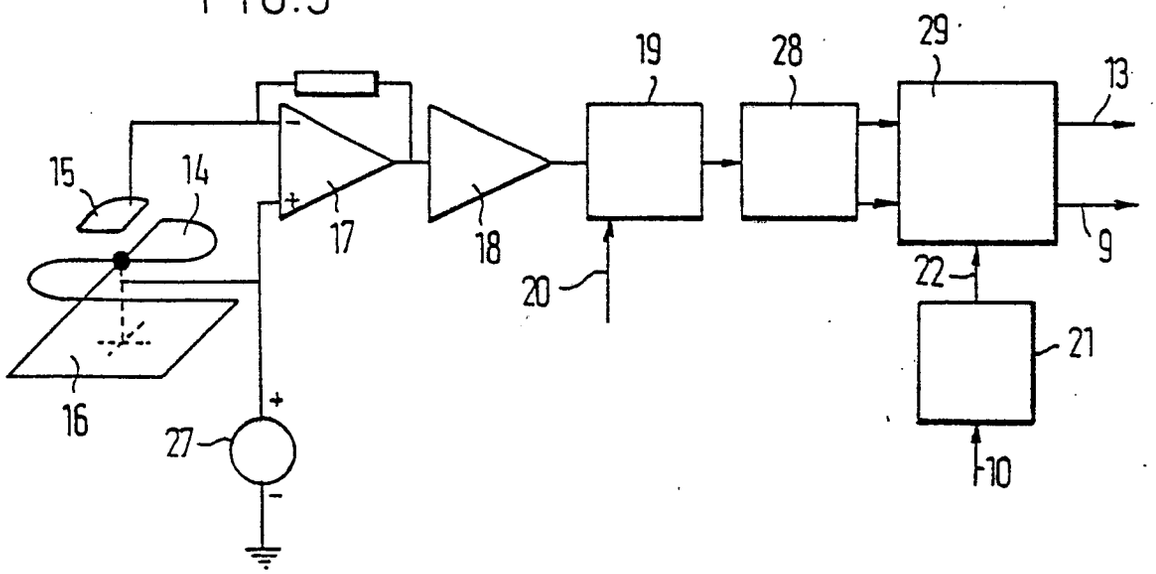


FIG.3



European Patent Office

EUROPEAN SEARCH REPORT

Application number

EP 83201650.5

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Y	US - A - 3 944 354 (BENWOOD) * Column 7, lines 1-55; fig. 1-4c; claims *	1,2,5	G 03 G 15/02 G 03 G 21/00
A		3,4	
	--		
Y	US - A - 3 934 141 (VARGAS) * Fig. 1-4; column 7, lines 37-53; column 8, lines 27-30; claims *	1,2,5	
A		3,4	
	--		
Y	US - A - 4 134 137 (JACOBS) * Fig. 1-7; column 6; claims *	1,2,5	
A		3,4	
	--		TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
Y	GB - A - 1 533 311 (XEROX) * Fig. 2; page 11, line 115 - page 12, lines12, 70-106 *	1,2	G 03 G 15/00 G 03 G 21/00 H 04 N 1/00 G 03 G 13/00
A		3,4	
	--		
A	DE - B2 - 2 007 728 (XEROX) * Fig. 1-5; claims *	1-5	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	30-12-1983	KRAL

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO Form 1503. 03.82