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(54) **Method for detecting an end portion of a recording paper in a recording apparatus and end portion detection apparatus**

Verfahren zum Nachweis des Endteiles eines Aufnahmepapiers in einem Aufnahmegerät und Nachweisgerät für ein Endteil

Procédé de détection de partie terminale d'un papier d'enregistrement dans un appareil d'enregistrement et appareil de détection pour une partie terminale

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pages 1894-1895, XP002028638 ANONYMOUS:
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EP 0 763 784 B1

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Description

[0001] The invention relates to technology for detecting a leading edge and a trailing edge of a recording paper, suitable for use in a recording apparatus such as a serial recording apparatus wherein a recording head is moved in the direction of a width of a recording paper and printing is carried out, and a page recording apparatus transferring a toner image formed on a photoconductive drum to a recording paper.

[0002] A recording apparatus detects the leading edge of a recording paper loaded from a paper supply port, sets the position of the recording paper leading edge at a constant position with respect to a recording line, carries out what is known as an initial printing position alignment operation and furthermore, if necessary, detects a trailing edge of the recording paper and carries out an operation to stop recording.

[0003] Detection of the leading and trailing edges of a recording paper is carried out by a switch disposed within the paper feed path which switches on by abutting with the recording paper and switches off by breaking contact with the end portion of the recording paper.

[0004] However, the problem of low detection accuracy exists due to such factors as the choice of mechanical construction for apparatus in which the structure and signal processing is simple.

[0005] For this reason, when a recording paper end portion is to be detected with a high level of accuracy, a method is adopted in which a sheet end detector comprising a light-emitting element irradiating a recording paper with light and a light-receiving element receiving reflected light from a recording paper is disposed in a position where it is possible to intercept light reflected from a recording paper, and the level of a signal from the sheet end detector is compared with a previously set standard level.

[0006] Because, as shown in FIG. 6(a), the light beam S1 of the light-emitting element which forms the sheet end detector has a slight spread, and in the same way the interception area S5 of the light-receiving element also has a slight spread, when recording paper P moves towards a printing region as shown by the arrow in the drawing, the amount of light reflected by the recording paper changes, and the signal level shown in FIG. 6(b); that is, the detector voltage, changes in proportion to the paper feed amount.

[0007] Then, because the amount of reflected light also changes according to the reflectance ratio of the recording paper, the rate of change of the detector voltage, that is, the slope, is also influenced by the recording paper reflectance ratio, finally it changes up to a saturation voltage V_{m1} and V_{m2} for the recording papers A and B respectively, decided by the respective recording paper reflectance ratio, and afterwards becomes constant.

[0008] For these two reasons, the amount of paper feeding up to the point of reaching a standard level standard value V_s determined to be the leading edge is

different due to the different reflectance ratios of a recording paper A and a recording paper B. Thus, when the leading edge of a recording paper P is identified an error ΔL occurs in the position where the paper is halted.

[0009] Because there are naturally variations in the level of irradiation of the light-emitting element and in the detection sensitivity of the light-receiving element which make up the sheet end detector, in order to reduce the size of this error ΔL , it is necessary to be selective and employ means in which the characteristics are the same, and this causes the problem of increased component costs.

[0010] GB 2220742A relates to the detection of the presence of a recording medium in a printer.

[0011] In order to achieve the above-mentioned objective, a method for detecting an end portion in a recording apparatus is proposed wherein, regardless of the characteristics of the paper; and moreover without the necessity for a high level of uniformity in a light-emitting element and a light-receiving element which compose a sheet end detector, it is possible to detect an end portion of a recording paper with a high level of accuracy.

[0012] Furthermore, another objective of this invention is to provide a recording paper end portion detection apparatus for implementing the above mentioned method.

[0013] In a first aspect, this invention provides a method for detecting a recording media end portion in a recording apparatus, wherein a recording media is irradiated with light and the position of an end portion is detected based on an amount of reflected light from said recording media, the method comprising the steps of:

memorizing the amount of reflected light from a recording media guide means;
 feeding forward a recording media, detecting the amount of reflected light of said media and calculating the difference between that amount of reflected light and the amount of light reflected from said media guide means; and
 setting a standard level, characterised by the step of setting a standard level including multiplying said difference by a value C which is greater than 0 and less than 1;
 pulling said recording media back in an upstream direction to a position where it is possible to detect the amount of light reflected only by said recording media guide means; and
 feeding forward said recording media and determining that a leading edge of said paper has reached a standard position at a point in time when the amount of reflected light equals said standard level.

[0014] In a second aspect, this invention provides an end portion detection apparatus in a recording apparatus, comprising:

a sheet end detector comprising a light-emitting element and a light-receiving element, detecting changes in the amount of light associated with movement of a recording media;

a standard value calculation means which detects an amount of difference $(V_m - V_p)$ or $(V_p - V_m)$ between said sheet end detector platen voltage V_p resulting from light reflected from a recording media guide means and said sheet end detector media saturation voltage V_m resulting from light reflected from a recording media, and calculates a standard value; and

a paper feed control means for feeding forward a recording media, characterised by said standard value $(V_m - V_p) \times C$ or $(V_p - V_m) \times C$ being calculated by multiplying by a constant coefficient C , where C is a numerical value greater than 0 and less than 1;

a comparing means for comparing said standard value and a signal from said sheet end detector and recognizing a point in time when said signal corresponds to said standard value as being indicative of the presence of a leading edge or trailing edge of a recording media; and

said paper feed control means being for feeding forward a recording media before commencing printing to a position where it is possible to detect said recording paper saturation voltage, then pulling said recording media back in an upstream direction to a position where it is possible to detect said platen voltage, and finally feeding forward said recording media to where a leading edge of said recording media is identified by said comparing means.

[0015] Thus, in order to solve the above problems, the invention consists of a method of detecting a recording paper end portion in a recording apparatus, wherein a recording paper is irradiated with light and the position of an end portion is detected based on an amount of reflected light from said recording paper, comprising the steps of: a process for recording the amount of reflected light from a recording paper guide means; a process for advancing a recording sheet, detecting the amount of reflected light of said sheet and calculating the difference between that amount of reflected light and the amount of light reflected from said media guide means; a process of setting a standard level by multiplying a value C which is greater than 0 and less than 1 by said difference; a process of pulling said recording paper back in a downstream direction to a position where it is possible to detect the amount of light reflected only by said recording paper guide means; and a process of feeding said recording paper in advance and determining that a leading edge of said paper has reached a standard position at a point in time when the amount of reflected light equals said standard level.

[0016] Because the paper feed amount necessary for the amount of reflected light only from a recording paper

guide means to reach the amount of reflected light only from a recording paper is constant regardless of the characteristics of the paper, the amount of the difference between the amounts of reflected light of the recording paper guide means and recording paper is constant, and the standard level obtained when this amount of difference is multiplied by a factor C is also constant, the relative position of a recording paper end portion with respect to the sheet end detector at the time when the amount of light has changed up to the standard level is also constant.

[0017] Embodiments of the invention will be described, by way of example only, with reference to the accompanying diagrammatic figures, in which:

[0018] FIG. 1 (a) and (b) are respectively drawings showing a serial recording apparatus to which the sheet end detection technology of the present invention is applicable, and the construction of the vicinity of a carriage thereof.

[0019] FIG. 2 is a block diagram showing one embodiment of a sheet end detection apparatus in the above-mentioned apparatus.

[0020] FIG. 3 (a) and (b) are respectively drawings showing the recognition operation of the position of a leading edge of a recording paper in the above-mentioned apparatus when the amount of reflected light from a recording paper guide means is less than that of a recording paper, and when it is higher than that of a recording paper.

[0021] FIG. 4 is a flow chart showing mainly the recognition operation of a recording paper leading edge and trailing edge in the above-mentioned apparatus.

[0022] FIG. 5(a) and (b) are respectively drawings showing the recognition operation in the above-mentioned apparatus of the position of the leading edges of recording paper and the trailing edges of recording paper when the amount of light reflected from each paper is different in the case where the amount of reflected light from a recording paper guide means is less than that of a recording paper, and where it is higher than that of a recording paper.

[0023] FIG. 6 (a) and (b) are respectively drawings showing the detection area of the sheet end detector and errors which occur when recording papers with a different amount of reflected light are aligned for printing.

[0024] Below, the present invention is explained based on an embodiment shown in the drawings.

[0025] FIG. 1(a) is a drawing showing an embodiment of the present invention, reference numeral 1 in the drawing is a carriage mounted with a recording head 2 (such as an impact wire type recording head, an ink jet type recording head or a thermal transfer type recording head) driven by a drive motor 5 via a timing belt 7 bridging idling rollers 6, and moving reciprocally along a guide 4 forming a recording head guide means disposed parallel to the axis of a paper feed roller 3.

[0026] On carriage 1, in the vicinity of recording head

2 as shown in FIG. 1(b), a sheet end detector 10 is disposed in a position spaced at a constant distance from the recording head 2 basic position. This sheet end detector 10, as is widely known, comprises a light-emitting element 11 irradiating paper feed roller 3, and a light-receiving element 12 disposed in a position where it is possible to intercept reflected light from paper feed roller 3 or a recording paper. Furthermore, reference numeral 13 shows a paper holder guiding a printing surface of a recording paper.

[0027] FIG. 2 is a drawing showing the sheet end detection apparatus which is a characteristic of the present invention; reference numeral 20 is a platen voltage detection means, detecting an amount of light in the condition before a recording paper is loaded, that is, the amount of reflected light from paper feed roller 3 forming a recording paper guide means, as the voltage (hereinafter referred to as platen voltage V_p) from a light-receiving element 12 composing sheet end detector 10.

[0028] Reference numeral 21 is a recording paper saturation voltage detection means, detecting an amount of light reflected by a recording paper itself as the voltage (hereinafter referred to as paper saturation voltage V_m) from a light-receiving element 12 comprising sheet end detector 10. The platen voltage V_p and paper saturation voltage V_m detected by these means 20 and 21 are respectively memorised in platen voltage memorising means 22 and paper saturation voltage memorising means 23.

[0029] 24 is a standard level calculating means, calculating $[(V_m - V_p) \times C] + V_p$ or $[(V_p - V_m) \times C] + V_m$ using the difference between platen voltage V_p and paper saturation voltage V_m memorized in platen voltage memorizing means 22 and paper saturation voltage memorizing means 23, and a positive value C , greater than 0 and less than 1, for example 0.3; and producing therefrom a standard determination level V_s for determining if a leading edge and also a trailing edge of a recording paper have reached a specified position. One of these two calculations is selected in dependence on whether V_p or V_m is larger. The calculation for which the value of the term in square brackets is positive is selected.

[0030] 25 is a comparing means, outputting a signal when a signal from sheet end detector 10 corresponds to the standard determination level V_s , detecting that either the leading edge or the trailing edge of a recording paper has reached a prescribed position. In particular, it is constructed to output a signal which is output after a recording paper is loaded as a forward paper feed halt signal to a paper feed control means 26, described later.

[0031] 26 is the previously mentioned paper feed control means; as shown in the flow chart described later, it controls the paper feed motor 8, driving it forwardly and in reverse in order to feed a recording paper, it stops feeding of the recording paper at the point in time when a forward paper feed halt signal is input from comparing means 25, and sets the recording paper at a prescribed

position in order to commence printing.

[0032] Next the operation of an apparatus constructed in this way is explained based on the graphs and flow-chart shown in FIG. 3 (a) and (b), and FIG. 4. FIG. 3 (a) shows the changes in a signal from a sheet end detector when a recording paper guide means is constructed from a material such as rubber which has a reflectance ratio lower than that of a recording paper; while FIG. 3 (b) shows the changes in a signal from a sheet end detector when a recording paper guide means is constructed from a base of metal or the like which has a reflectance ratio higher than that of a recording paper, and paper feeding is carried out by a roller disposed in another location. Note that the values in the case of FIG. 3(b) are denoted by apostrophes.

[0033] As shown in FIG. 4, when a power source is switched on (Step A), the presence or absence of a recording paper is detected by the sheet end detector and other paper detectors (Step B), and if a recording paper is present, paper feed roller 3 is rotated and the paper is discharged (Step C).

[0034] As light from the light-emitting element 11 of sheet end detector 10 irradiates paper feed roller 3 in the condition when a recording paper is absent, light-receiving element 12 intercepts reflected light from paper feed roller 3. The amount of reflected light from paper feed roller 3 detected by platen voltage detection means 20 is memorized in platen voltage memorizing means 22 as platen voltage V_p or V_p' (Step D).

[0035] Next, a recording paper is loaded (Step E), and paper feed control means rotates paper feed motor 8 in a forward direction and the recording paper is fed forwardly (Step F). When the leading edge of the recording paper reaches the vicinity of sheet end detector 10 due to the feeding, as light from light-emitting element 11 is reflected from paper feed roller 3 and the recording paper, the amount of light admitted to light receiving element 12 changes at a rate of change governed by the reflectance ratio of the recording paper.

[0036] Consequently, as shown in FIG. 3 (a) and (b), the voltage of the signal from sheet end detector 10 gradually changes according to the differences in the reflectance ratios of the recording paper guide means and the recording paper. That is, when the reflectance ratio of the recording paper guide means is lower than that of the recording paper the voltage gradually increases, and when the reflectance ratio of the recording paper guide means is higher, it gradually decreases. When the recording paper is moved as far as a position where all of the light from light-emitting element 11 irradiating the paper feed roller 3 is reflected by the recording paper, the signal from the sheet end detector reaches the level of an amount of light governed by the reflectance ratio of the recording paper, that is a saturation amount of light.

[0037] By doing this, all the light admitted to light-receiving element 12 becomes the reflected light from the recording paper, and regardless of the amount of paper

feeding, the signal from sheet end detector 10 reaches a voltage decided according to the reflectance ratio of the recording paper; that is, paper saturation voltage V_m or V_m' (Step G), and this becomes thereafter a constant value. Paper saturation voltage detector 21 detects this paper saturation voltage V_m or V_m' and memorizes it in paper saturation voltage memorizing means 23 (Step H).

[0038] Meter paper saturation voltage V_m or V_m' is detected and memorized, paper feed control means 26 rotates paper feed motor 8 in reverse, feeds the recording paper in a reverse direction (Step I), and pauses the leading edge of the recording paper outside the detection region of sheet end detector 10. As this pausing operation continues, light from the light-emitting element 11 of sheet end detector 10 irradiates paper feed roller 3 only, and in the stage where the platen voltage is detected again by platen voltage detection means 20 (Step J) the recording paper is fed in reverse by a predetermined number of pulses only (Step K). Otherwise, Step I is repeated.

[0039] Next, paper feed control means 26 rotates paper feed motor 8 forwardly and feeds the recording paper forward towards recording head 2 (Step L). By doing this, as the leading edge of the recording paper enters the detection region of sheet end detector 10, the amount of light from the light-emitting element 11 of sheet end detector 10 admitted to the light-receiving element 12 corresponds to the reflectance ratios of the recording paper guide means and recording paper, and changes in proportion to the amount of paper feeding.

[0040] Comparing means 25 compares the signal from sheet end detector 10 and the relevant recording paper determination standard V_s and V_s' calculated by standard level calculation means 24 (Step M), at the point in time when the amount of reflected light corresponds to standard values V_s or V_s' , it is identified that the leading edge of the recording paper N_s has reached a standard position N_t (Step N), and furthermore, paper feed control means 26 halts the paper feeding operation and positions the leading edge of the recording paper N_s at prescribed position N_t (Step O).

[0041] Namely, as shown in FIG. 5 (a) and (b), the values of the amount of light in the condition where the light from light-emitting element 11 of sheet end detector 10 is reflected only from the recording paper, that is, paper saturation voltage V_{m1} , V_{m2} or V_{m1}' , V_{m2}' , are influenced by the reflectance ratios due to the characteristics of recording papers A and B. However, the values of the amount of light in the condition where the light from light-emitting element 11 of sheet end detector 10 is reflected only from the paper feed roller 3, that is, platen voltage V_p or V_p' , become fixed at characteristic values decided by the reflectance ratio of the paper feed roller. Therefore, each difference between the recording paper and paper feed roller 3: $(V_{m1} - V_p)$ and $(V_{m2} - V_p)$, or $(V_p' - V_{m1}')$ and $(V_p' - V_{m2}')$ is determined principally by the reflectance ratio of each recording paper loaded at the

time of printing.

[0042] Then, the paper feeding amount required for the amount of light reflected only from paper feed roller 3 to change only differences $(V_{m1} - V_p)$ and $(V_{m2} - V_p)$, or $(V_p' - V_{m1}')$ and $(V_p' - V_{m2}')$ is principally determined by the optical coefficients of light-emitting element 11 and light-receiving element 12 constructing sheet end detector 10, that is, the diameter of the light-emitting element beam and the area of possible reception of the light-receiving element.

[0043] Consequently, at the point in time when signals corresponding to standard determination values or levels $V_{sa} = [(V_{m1} - V_p) \times C] + V_p$, $V_{sb} = [(V_{m2} - V_p) \times C] + V_p$, or $V_{sa}' = [(V_p' - V_{m1}') \times C] + V_{m1}'$, $V_{sb}' = [(V_p' - V_{m2}') \times C] + V_{m2}'$ (obtained from multiplying these differences $(V_{m1} - V_p)$ and $(V_{m2} - V_p)$, or $(V_p' - V_{m1}')$ and $(V_p' - V_{m2}')$ by a constant ratio and adding the respective lower value V_p , V_{m1}' or V_{m2}') are output from sheet end detector 10, the relative position N_t of the leading edge of the recording paper with respect to sheet end detector 10 becomes constant regardless of the characteristics of the recording paper. This relative position N_t is constant for a given value of C and can be altered by selecting a different value of C .

[0044] A print command is input (Step P), printing is commenced (Step Q), printing continues up to the vicinity of the trailing edge of the recording paper, and as the recording paper begins to move away from sheet end detector 10, the amount of light admitted to sheet end detector 10 is governed by the paper feed roller 3 reflectance ratio, and is governed by the ratio of the areas of paper feed roller 3 and the sheet of paper within the detection area of leading edge detector 11, and the signal from sheet end detector 10 gradually changes.

[0045] Comparing means 25 compares the signal from sheet end detector 10 and the standard level $[(V_{m1} - V_p) \times C] + V_p$, $[(V_{m2} - V_p) \times C] + V_p$ or $[(V_p' - V_{m1}') \times C] + V_{m1}'$, $[(V_p' - V_{m2}') \times C] + V_{m2}'$ (Step R), and when they correspond, it identifies that the trailing edge N_e of the recording paper has reached standard position N_b (Step S). When one page of printing is completed, discharging is carried out (Step. T), if printing data still remains, the process moves to Step (D) again (Step U), and the previously described processes are repeated.

[0046] Of course, as these standard levels $[(V_{m1} - V_p) \times C] + V_p$, $[(V_{m2} - V_p) \times C] + V_p$ and $[(V_p' - V_{m1}') \times C] + V_{m1}'$, $[(V_p' - V_{m2}') \times C] + V_{m2}'$ are set at the time of commencement of printing based on the reflectance ratio of the recording paper in question, the recording paper which has finished being printed has the same nature as at the time of the first sheet end detection, consequently at the time when the signal from sheet end detector 10 corresponds to the standard level value for the second time, the trailing edge N_e of the paper in question reaches a constant position N_b with respect to sheet end detector 10.

[0047] Namely, as shown in FIG. 5 (a) and (b), the values of the amount of light in the condition where the light

from light-emitting element 11 of sheet end detector 10 is reflected only from the recording paper, that is, paper saturation voltage V_{m1} and V_{m2} , or $V_{m1'}$ and $V_{m2'}$, are influenced by the reflectance ratios due to the characteristics (paper roughness etc.) of recording papers A and B. However, the values of the amount of light in the condition where the light from light-emitting element 11 of sheet end detector 10 is reflected only from the paper feed roller 3, that is, platen voltage V_p and $V_{p'}$, become fixed at characteristic values decided by the reflectance ratio of the paper feed roller. Therefore, each difference between the recording paper and paper feed roller 3: $(V_{m1} - V_p)$ and $(V_{m2} - V_p)$, or $(V_{p'} - V_{m1'})$ and $(V_{p'} - V_{m2'})$ is determined principally by the reflectance ratio of each recording paper loaded at the time of printing.

[0048] Then, the paper feeding amount required for the amount of light reflected only from the recording paper to change only differences $[(V_{m1} - V_p) \times C] + V_p$ and $[(V_{m2} - V_p) \times C] + V_p$, or $[(V_{p'} - V_{m1'}) \times C] + V_{m1'}$ and $[(V_{p'} - V_{m2'}) \times C] + V_{m2'}$ is principally determined by the optical coefficients of light-emitting element 11 and light-receiving element 12 constructing sheet end detector 10, that is, the diameter of the light-emitting element beam and the area of possible reception of the light-receiving element.

[0049] Consequently, at the point in time when signals corresponding to determination standard values $V_{sa} = [(V_{m1} - V_p) \times C] + V_p$, $V_{sb} = [(V_{m2} - V_p) \times C] + V_p$, or $V_{sa'} = [(V_{p'} - V_{m1'}) \times C] + V_{m1'}$, $V_{sb'} = [(V_{p'} - V_{m2'}) \times C] + V_{m2'}$, are output from sheet end detector 10, the relative position N_b of the trailing edge N_e of the recording paper with respect to sheet end detector 10 becomes constant regardless of the nature of the recording paper. This relative position N_b is constant for a given value of C and can be altered by selecting a different value of C .

[0050] Thus, even with the variations in strength of light emission and area of irradiation in light-emitting elements 11, and sensitivity and range of possible interception of light-receiving elements 12 composing sheet end detectors 10 disposed in a plurality of recording apparatus; these are peculiar to each sheet end detector 11, that is, as they are factors determined unrelated to the type of recording paper, even if there are variations between recording apparatus in the position where a leading edge or trailing edge is identified, the position where the leading edge or trailing edge is identified in each recording apparatus is constant, irrespective of the nature of the paper. Therefore, as variations between recording apparatus in the position where a leading edge or trailing edge is identified can be easily corrected by adjusting the position of the sheet end detector 11, as a result it is possible to detect the leading edge and trailing edge with a constant level of accuracy. Alternatively, variations can be corrected by altering the value of C used.

[0051] Furthermore, in the embodiment described above, it is explained in the case where it is applied to a serial type apparatus, but even if used as a recording

paper detection means for a page recording apparatus transferring a toner image formed on a photoconductive drum to a recording paper, it is clear that a similar effect can be obtained.

[0052] Yet further, in the embodiment described above, the leading edge and trailing edge of a recording paper are detected by the same detector, but if a second sheet end detector having the same construction for detecting a trailing edge is disposed in a position suitable for detecting the trailing edge, even if the amount of light detected by this second sheet end detector is compared to a standard level determined when printing first commences, if there is at least no influence due to changes in the nature of the paper, the same position can be detected as the trailing edge.

[0053] As explained above, the present invention comprises a process for recording the amount of reflected light from a recording paper guide means; a process for advancing a recording sheet, detecting the amount of reflected light of said sheet and calculating the difference between that amount of reflected light and the amount of light reflected from said media guide means; a process of setting a standard level by multiplying a value C which is greater than 0 and less than 1 by said difference; a process of pulling said recording paper back in an upstream direction to a position where it is possible to detect the amount of light reflected only by said recording paper guide means; and a process of advancing said recording paper and determining that a leading edge of said paper has reached a standard position at a point in time when the amount of reflected light equals said standard level; wherein the leading edge and trailing edge of a recording paper can be identified at a high level of accuracy regardless of the nature of the recording paper and the detection region and sensitivity of the sheet end detector, and the standard for components making up the sheet end detector can be relaxed, and the cost can be reduced.

[0054] Although the above description is given in terms of a recording paper, the present invention can be applied to any recording media.

[0055] The foregoing description has been given by way of example only and it will be appreciated by a person skilled in the art that modifications can be made without departing from the scope of the present invention.

Claims

1. A method for detecting a recording media end portion in a recording apparatus, wherein a recording media is irradiated with light and the position of an end portion is detected based on an amount of reflected light from said recording media, the method comprising the steps of:

memorizing the amount of reflected light from

a recording media guide means (3);
 feeding forward a recording media, detecting
 the amount of reflected light of said media and
 calculating the difference between that amount
 of reflected light and the amount of light reflect- 5
 ed from said media guide means; and
 setting a standard level, **characterised by**
 the step of setting a standard level including
 multiplying said difference by a value C which
 is greater than 0 and less than 1; 10
 pulling said recording media back in an up-
 stream direction to a position where it is possi-
 ble to detect the amount of light reflected only
 by said recording media guide means; and
 feeding forward said recording media and de- 15
 termining that a leading edge of said paper has
 reached a standard position at a point in time
 when the amount of reflected light equals said
 standard level. 20

2. The method for detecting a recording media end portion in a recording apparatus of claim 1, further comprising:

a process wherein during the conveying process of said recording media, a second point in time when said amount of reflected light again corresponds to said standard level is determined as being indicative of the presence of a trailing edge of a recording media. 25

3. The method for detecting a recording media end portion in a recording apparatus of claim 1, further comprising:

selecting a value C in such a way that a standard level can be set between the reflectance ratio of said recording media guide means and a reflectance ratio of a recording media closest to the reflectance ratio of said recording media guide means. 30

4. An end portion detection apparatus in a recording apparatus, comprising:

a sheet end detector (10) comprising a light-emitting element (11) and a light-receiving element (12), detecting changes in the amount of light associated with movement of a recording media; 45

a standard value calculation means (24) which detects an amount of difference ($V_m - V_p$) or ($V_p - V_m$) between said sheet end detector platen voltage V_p resulting from light reflected from a recording media guide means (3) and said sheet end detector media saturation voltage V_m resulting from light reflected from a recording media, and calculates a standard value; and
 a paper feed control means (26) for feeding forward a recording media, **characterised by** 50

said standard value $(V_m - V_p) \times C$ or $(V_p - V_m) \times C$ being calculated by multiplying by a constant coefficient C, where C is a numerical value greater than 0 and less than 1;

a comparing means (25) for comparing said standard value and a signal from said sheet end detector and recognizing a point in time when said signal corresponds to said standard value as being indicative of the presence of a leading edge or trailing edge of a recording media; and
 said paper feed control means (26) being for feeding forward a recording media before commencing printing to a position where it is possible to detect said recording paper saturation voltage, then pulling said recording media back in an upstream direction to a position where it is possible to detect said platen voltage, and finally feeding forward said recording media to where a leading edge of said recording media is identified by said comparing means. 55

5. The end portion detection apparatus as claimed in claim 4, wherein:

when the sheet end detector platen voltage V_p is greater than the sheet end detector media saturation voltage V_m , said standard value is $[(V_p - V_m) \times C] + V_m$; and when the sheet end detector media saturation voltage V_m is greater than the sheet end detector platen voltage V_p , said standard value is $[(V_m - V_p) \times C] + V_p$. 30

6. The end portion detection apparatus in a recording apparatus of claim 4 or claim 5, wherein:

said comparing means outputs a signal at a point in time during the printing process when a signal from said media end detector corresponds to said standard value. 35

7. The end portion detection apparatus in a recording apparatus of any one of claims 4 to 6, wherein:

a value C is selected in such a way that a standard level can be set between the reflectance ratio of said recording paper guide means and a reflectance ratio of a recording paper closest to the reflectance ratio of said recording paper guide means. 40

8. The end portion detection apparatus in a recording apparatus of any one of claims 4 to 7, wherein:

said paper feed control means stops a paper feeding operation in response to a first signal from said comparing means. 45

9. The end portion detection apparatus in a recording apparatus of any one of claims 4 to 8, wherein:

said paper feed control means feeds forward a recording paper before commencing printing to a position where it is possible to detect said recording 50

paper saturation voltage, then pulls said recording paper back towards a downstream side by a further constant amount to beyond a position where it is possible to detect said platen voltage, and finally feeds forward said recording paper to where a leading edge of said recording paper is identified by said comparing means.

10. The end portion detection apparatus in a recording apparatus of any one of claims 4 to 9, wherein:
said sheet end detector is arranged in such a way that a light-emitting element and a light-receiving element are optically opposed by said recording paper guide means.

Patentansprüche

1. Verfahren zum Erfassen eines Aufzeichnungsmedium-Endabschnitts in einer Aufzeichnungsvorrichtung, in der ein Aufzeichnungsmedium mit Licht bestrahlt wird und die Position eines Endabschnitts erfaßt wird auf der Grundlage einer vom Aufzeichnungsmedium reflektierten Lichtmenge, wobei das Verfahren die Schritte umfaßt:

Speichern der von einem Aufzeichnungsmedium-Führungsmittel (3) reflektierten Lichtmenge;

Vorrücken eines Aufzeichnungsmediums, Erfassen der vom Medium reflektierten Lichtmenge und Berechnen der Differenz zwischen der reflektierten Lichtmenge und der vom Medium-Führungsmittel reflektierten Lichtmenge; und Setzen eines Standardpegels, **gekennzeichnet durch**

den Schritt des Setzens eines Standardpegels, der das Multiplizieren der Differenz mit einem Wert C enthält, der größer als 0 und kleiner als 1 ist;

Zurückziehen des Aufzeichnungsmediums stromaufwärts zu einer Position, in der es möglich ist, nur die vom Aufzeichnungsmedium-Führungsmittel reflektierte Lichtmenge zu erfassen; und

Vorrücken des Aufzeichnungsmediums und Ermitteln, daß eine Vorderkante des Papiers eine Standardposition erreicht hat zu einem Zeitpunkt, zu dem die reflektierte Lichtmenge gleich dem Standardpegel ist.

2. Verfahren zum Erfassen eines Aufzeichnungsmedium-Endabschnitts in einer Aufzeichnungsvorrichtung nach Anspruch 1, das ferner umfaßt:

einen Prozeß, in welchem während des Förderprozesses des Aufzeichnungsmediums ein zweiter Zeitpunkt, zu dem die reflektierte Lichtmenge erneut dem Standardpegel entspricht, als Anzei-

ge für die Anwesenheit einer Hinterkante eines Aufzeichnungsmediums ermittelt wird.

3. Verfahren zum Erfassen eines Aufzeichnungsmedium-Endabschnitts in einer Aufzeichnungsvorrichtung nach Anspruch 1, das ferner umfaßt:

Auswählen eines Wertes C derart, daß ein Standardpegel gesetzt werden kann zwischen einem Reflektivitätsverhältnis des Aufzeichnungsmedium-Führungsmittels und einem Reflektivitätsverhältnis eines Aufzeichnungsmediums, das dem Reflektivitätsverhältnis des Aufzeichnungsmedium-Führungsmittels am nächsten kommt.

4. Endabschnitterfassungsvorrichtung in einer Aufzeichnungsvorrichtung, die umfaßt:

einen Blattende-Detektor (10), der ein lichtemittierendes Element (11) und ein lichtempfangendes Element (12) umfaßt und Änderungen der Lichtmenge erfaßt, die der Bewegung eines Aufzeichnungsmediums zugeordnet sind;

ein Standardwert-Berechnungsmittel (24), das ein Differenzmaß ($V_m - V_p$) oder ($V_p - V_m$) zwischen der Blattende-Detektor-Auflageplattenspannung V_p , die aus dem von einem Aufzeichnungsmedium-Führungsmittel (3) reflektierten Licht resultiert, und der Blattende-Detektor-Mediumsättigungsspannung V_m , die aus dem von einem Aufzeichnungsmedium reflektierten Licht resultiert, erfaßt und einen Standardwert berechnet; und ein Papierzufuhrsteuerungsmittel (26), zum Vorrücken eines Aufzeichnungsmediums,

dadurch gekennzeichnet, daß

der Standardwert $(V_m - V_p) \cdot C$ oder $(V_p - V_m) \cdot C$ berechnet wird durch Multiplizieren mit einem konstanten Koeffizienten C, wobei C ein numerischer Wert größer als 0 und kleiner als 1 ist;

ein Vergleichsmittel (25) vorgesehen ist zum Vergleichen des Standardwertes und eines Signals vom Blattende-Detektor und zum Erkennen eines Zeitpunktes, zu dem das Signal dem Standardwert entspricht, als Anzeige für die Anwesenheit einer Vorderkante oder einer Hinterkante eines Aufzeichnungsmediums; und das Papierzufuhrsteuerungsmittel (26) zum Vorrücken eines Aufzeichnungsmediums vor dem Beginn des Druckens zu einer Position dient, in der es möglich ist, die Aufzeichnungspapier-sättigungsspannung zu erfassen, woraufhin das Aufzeichnungsmedium stromaufwärts zu einer Position zurückgezogen wird, in der es möglich ist, die Auflageplattenspannung zu erfassen, und schließlich das Aufzeichnungsmedium

vorgerückt wird, bis eine Vorderkante des Aufzeichnungsmediums vom Vergleichsmittel identifiziert wird.

5. Endabschnitterfassungsvorrichtung nach Anspruch 4, bei der:
dann, wenn die Blattende-Detektor-Auflageplattenspannung V_p größer ist als die Blattende-Detektor-Mediumsättigungsspannung V_m , der Standardwert gleich $[(V_p - V_m) C] + V_m$ ist; und dann, wenn die Blattende-Detektor-Mediumsättigungsspannung V_m größer ist als die Blattende-Detektor-Auflageplattenspannung V_p , der Standardwert gleich $[(V_m - V_p) \cdot C] + V_p$ ist.
6. Endabschnitterfassungsvorrichtung in einer Aufzeichnungsvorrichtung nach Anspruch 4 oder Anspruch 5, bei der:
das Vergleichsmittel ein Signal zu einem Zeitpunkt während des Druckprozesses ausgibt, zu dem ein Signal vom Mediumende-Detektor dem Standardwert entspricht.
7. Endabschnitterfassungsvorrichtung in einer Aufzeichnungsvorrichtung nach irgendeinem der Ansprüche 4 bis 6, bei der:
ein Wert C so gewählt wird, daß ein Standardpegel gesetzt werden kann zwischen einem Reflektivitätsverhältnis des Aufzeichnungspapier-Führungsmittels und einem Reflektivitätsverhältnis eines Aufzeichnungspapiers, das dem Reflektivitätsverhältnis des Aufzeichnungspapier-Führungsmittels am nächsten kommt.
8. Endabschnitterfassungsvorrichtung in einer Aufzeichnungsvorrichtung nach irgendeinem der Ansprüche 4 bis 7, bei der
das Papierzufuhrsteuermittel eine Papierzufuhroperation in Reaktion auf ein erstes Signal vom Vergleichsmittel stoppt.
9. Endabschnitterfassungsvorrichtung in einer Aufzeichnungsvorrichtung nach irgendeinem der Ansprüche 4 bis 8, bei der
das Papierzufuhrsteuermittel ein Aufzeichnungspapier vor Beginn des Druckens zu einer Position vorrückt, in der es möglich ist, die Aufzeichnungspapiersättigungsspannung zu erfassen, anschließend das Aufzeichnungspapier stromabwärts um ein weiteres konstantes Maß bis jenseits einer Position zurückzieht, in der es möglich ist, die Auflageplattenspannung zu erfassen, und schließlich das Aufzeichnungspapier vorrückt, bis eine Vorderkante des Aufzeichnungspapiers vom Vergleichsmittel identifiziert wird.
10. Endabschnitterfassungsvorrichtung in einer Aufzeichnungsvorrichtung nach irgendeinem der An-

sprüche 4 bis 9, bei der:

der Blattende-Detektor so angeordnet ist, daß ein lichtemittierendes Element und ein lichtempfangendes Element optisch dem Aufzeichnungspapier-Führungsmittel gegenüberliegen.

Revendications

1. Procédé pour détecter une partie d'extrémité d'un support d'enregistrement dans un appareil d'enregistrement, dans lequel le support d'enregistrement est irradié avec de la lumière et la position d'une partie d'extrémité est détectée sur la base d'une quantité de lumière réfléchie provenant dudit support d'enregistrement, le procédé comprenant les étapes consistant à :
- mémoriser la quantité de lumière réfléchie provenant d'un moyen de guidage de support d'enregistrement (3) ; avancer vers l'avant un support d'enregistrement, détecter la quantité de lumière réfléchie dudit support et calculer la différence entre cette quantité de lumière réfléchie et la quantité de lumière réfléchie depuis le moyen de guidage de support ; et établir un niveau standard, **caractérisé par** l'étape consistant à établir un niveau standard incluant la multiplication de ladite différence par une valeur C qui est plus grande que zéro et plus petite que 1 ; tirer ledit support d'enregistrement en arrière dans une direction en amont à une position où il n'est possible de détecter la quantité de lumière réfléchie que par ledit moyen de guidage de support d'enregistrement ; et avancer ledit support d'enregistrement et déterminer qu'un bord avant dudit papier a atteint une position standard au moment où la quantité de lumière réfléchie est égale audit niveau standard.
2. Procédé pour détecter une partie d'extrémité d'un support d'enregistrement dans un appareil d'enregistrement selon la revendication 1, comprenant en outre :
- un traitement dans lequel pendant le processus de transport dudit support d'enregistrement, un second moment où ladite quantité de lumière réfléchie correspond de nouveau audit niveau standard est déterminé comme étant représentatif de la présence d'un bord arrière d'un support d'enregistrement.
3. Procédé pour détecter une partie d'extrémité d'un support d'enregistrement dans un appareil d'enregistrement selon la revendication 1, comprenant en outre l'étape consistant à :

sélectionner une valeur C d'une manière telle qu'un niveau standard peut être établi entre le rapport de pouvoir de réflexion dudit moyen de guidage de support d'enregistrement et le rapport de pouvoir de réflexion d'un support d'enregistrement plus proche du rapport de pouvoir de réflexion dudit moyen de guidage de support d'enregistrement.

4. Appareil de détection de partie d'extrémité dans un appareil d'enregistrement, comprenant :

un détecteur d'extrémité de feuilles (10) comprenant un élément à émission de lumière (11) et un élément récepteur de lumière (12), détectant des changements de quantité de lumière associés au déplacement d'un support d'enregistrement ;

un moyen de calcul de valeur standard (24) qui détecte une quantité de différence ($V_m - V_p$) ou ($V_p - V_m$) entre ladite tension de cylindre du détecteur d'extrémité de feuilles V_p résultant de la lumière réfléchie depuis un moyen de guidage de support d'enregistrement (3) et ladite tension de saturation du support du détecteur d'extrémité de feuilles V_m résultant de la lumière réfléchie depuis un support d'enregistrement, et calcule une valeur standard ; et

un moyen de commande d'avancée de papier (26) pour avancer un support d'enregistrement, **caractérisé par**

ladite valeur standard $(V_m - V_p) \times C$ ou $(V_p - V_m) \times C$ qui est calculée en multipliant par un coefficient constant C, où C est une valeur numérique plus grande que zéro et plus petite que 1 ;

un moyen de comparaison (25) pour comparer ladite valeur standard et un signal provenant du détecteur d'extrémité de feuilles et pour reconnaître un moment où ledit signal correspond à ladite valeur standard comme étant indicatif de la présence d'un bord avant ou d'un bord arrière d'un support d'enregistrement ; et

ledit moyen de commande d'avancée de papier (26) qui est utilisé pour avancer un support d'enregistrement avant de commencer l'impression à une position où il est possible de détecter ladite tension de saturation de papier d'enregistrement, pour tirer ensuite le support d'enregistrement en arrière dans une direction en amont à une position où il est possible de détecter ladite tension du cylindre, et pour avancer finalement ledit support d'enregistrement où un bord arrière dudit support d'enregistrement est identifié par ledit moyen de comparaison.

5. Appareil de détection de partie d'extrémité selon la revendication 4, dans lequel :

lorsque la tension du cylindre du détecteur d'extrémité de feuilles V_p est plus grande que la tension de saturation du support du détecteur d'extrémité de feuilles V_m , ladite valeur standard est $[(V_p - V_m) \times C] + V_m$; et lorsque la tension de saturation de support du détecteur d'extrémité de feuilles V_m est plus grande que la tension du cylindre du détecteur d'extrémité de feuilles V_p , ladite valeur standard est $[(V_m - V_p) \times C] + V_p$.

6. Appareil de détection de partie d'extrémité dans un appareil d'enregistrement selon la revendication 4 ou la revendication 5, dans lequel :

ledit moyen de comparaison sort un signal à un moment pendant le traitement d'impression lorsqu'un signal provenant du détecteur d'extrémité de support correspond à ladite valeur standard.

7. Appareil de détection de partie d'extrémité dans un appareil d'enregistrement selon l'une quelconque des revendications 4 à 6, dans lequel :

une valeur C est sélectionnée d'une manière telle qu'un niveau standard peut être établi entre le rapport de pouvoir de réflexion dudit moyen de guidage de papier d'enregistrement et un rapport de pouvoir de réflexion d'un papier d'enregistrement le plus proche du rapport de pouvoir de réflexion dudit moyen de guidage de papier d'enregistrement.

8. Appareil de détection de partie d'extrémité dans un appareil d'enregistrement selon l'une quelconque des revendications 4 à 7, dans lequel :

ledit moyen de commande d'avancée de papier arrête une opération d'avancée de papier en réponse à un premier signal provenant dudit moyen de comparaison.

9. Appareil de détection de partie d'extrémité dans un appareil d'enregistrement selon l'une quelconque des revendications 4 à 8, dans lequel :

ledit moyen de commande d'avancée de papier avance un papier d'enregistrement avant de commencer l'impression à une position où il est possible de détecter ladite tension de saturation du papier d'enregistrement, tire ensuite ledit papier d'enregistrement en arrière vers un côté en aval par une autre quantité constante au-delà de la position où il est possible de détecter ladite tension du cylindre, et finalement avance ledit papier d'enregistrement à un endroit où un bord avant dudit papier d'enregistrement est identifié par ledit moyen de comparaison.

10. Appareil de détection de partie d'extrémité dans un appareil d'enregistrement selon l'une quelconque des revendications 4 à 9, dans lequel :

ledit détecteur d'extrémité de feuilles est disposé d'une manière telle qu'un élément émetteur

de lumière et un élément récepteur de lumière sont optiquement opposés par ledit moyen de guidage de papier d'enregistrement.

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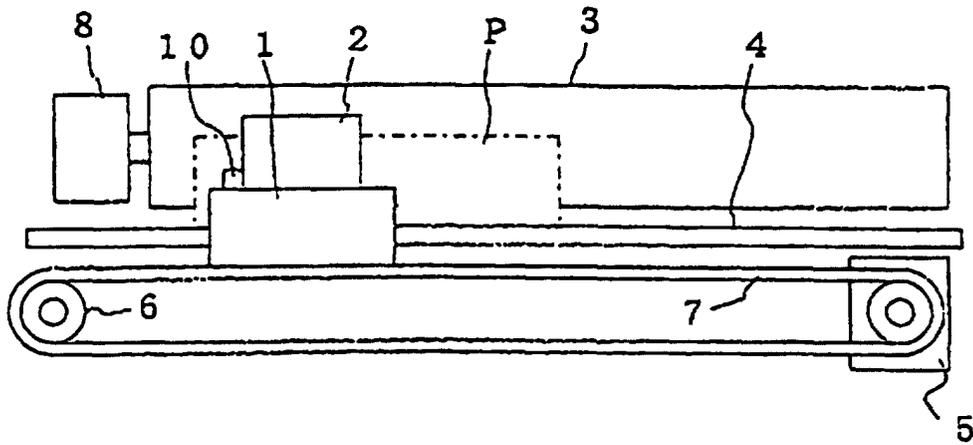
45

50

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FIG. 1

(a)



(b)

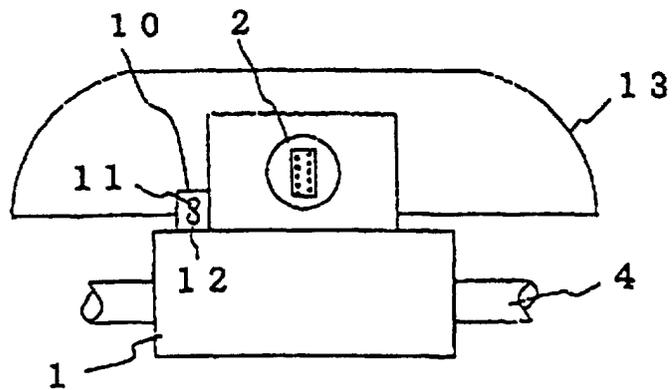


FIG. 2

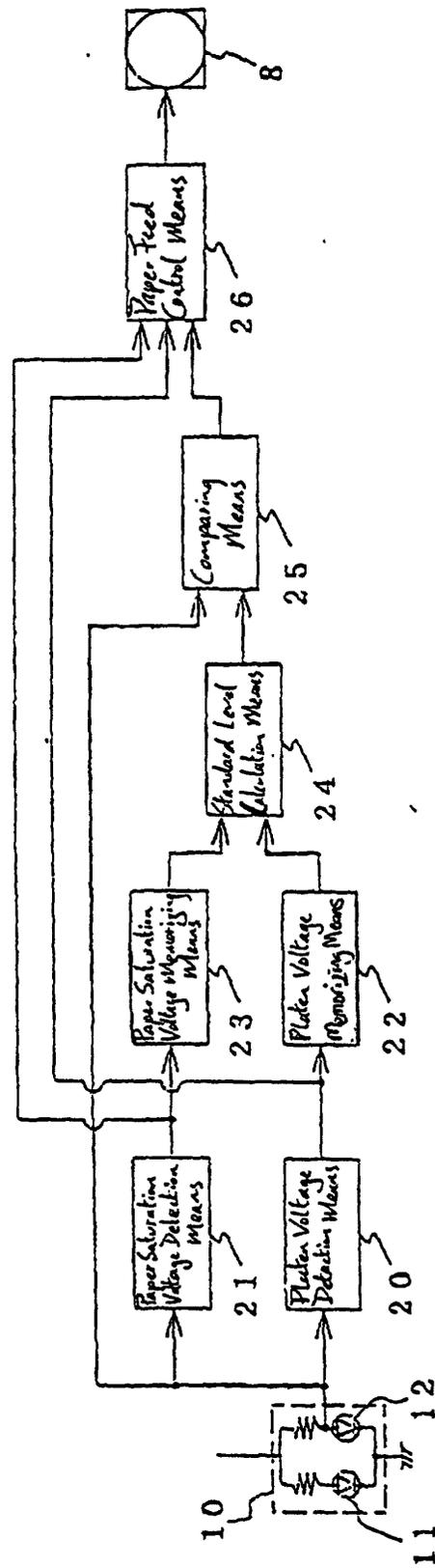


FIG. 3

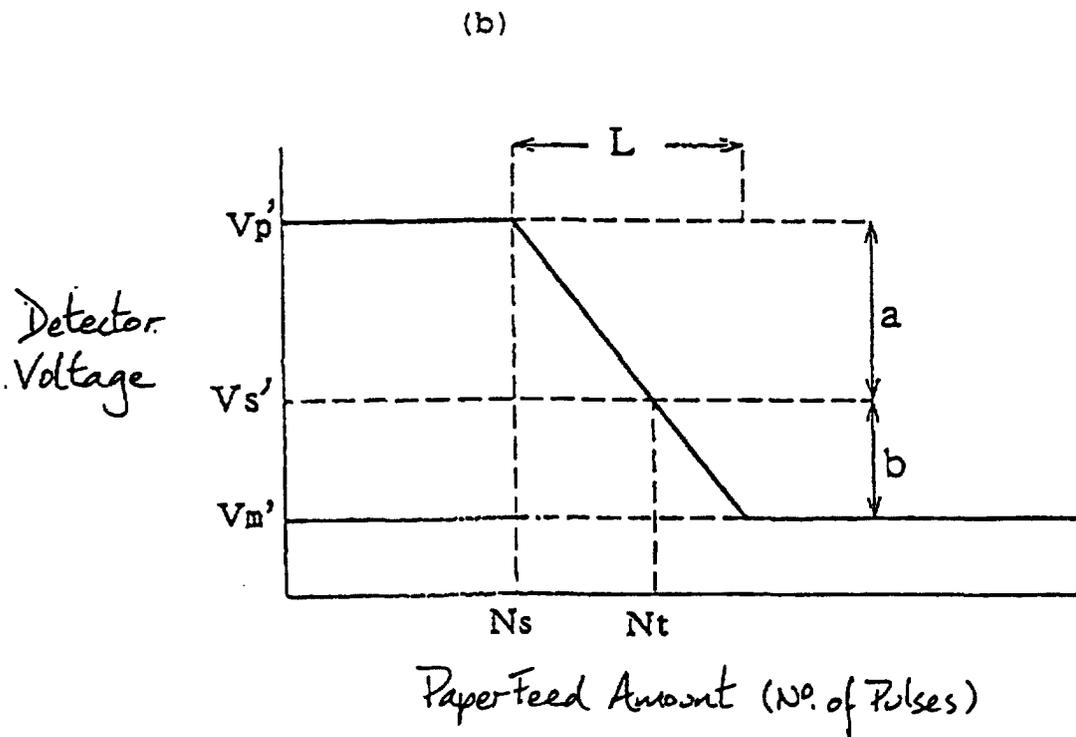
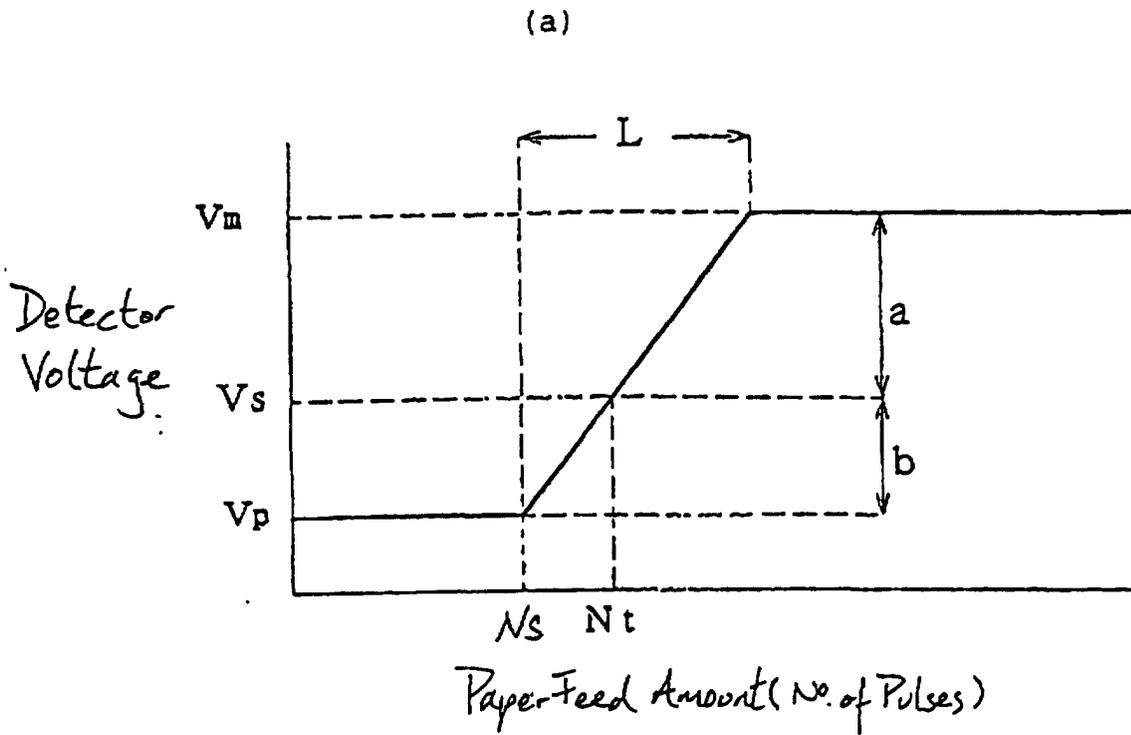


FIG. 4

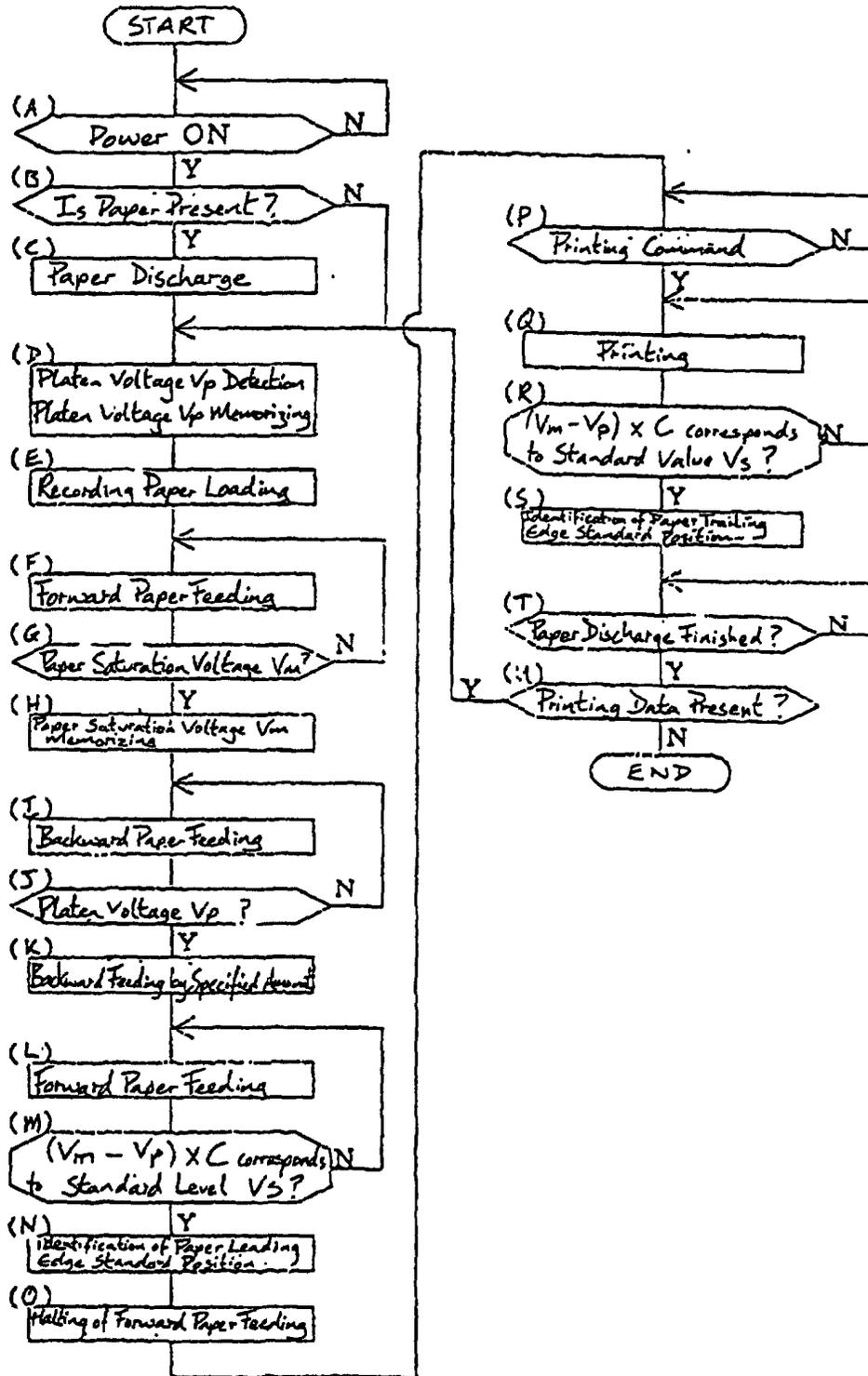


FIG. 5

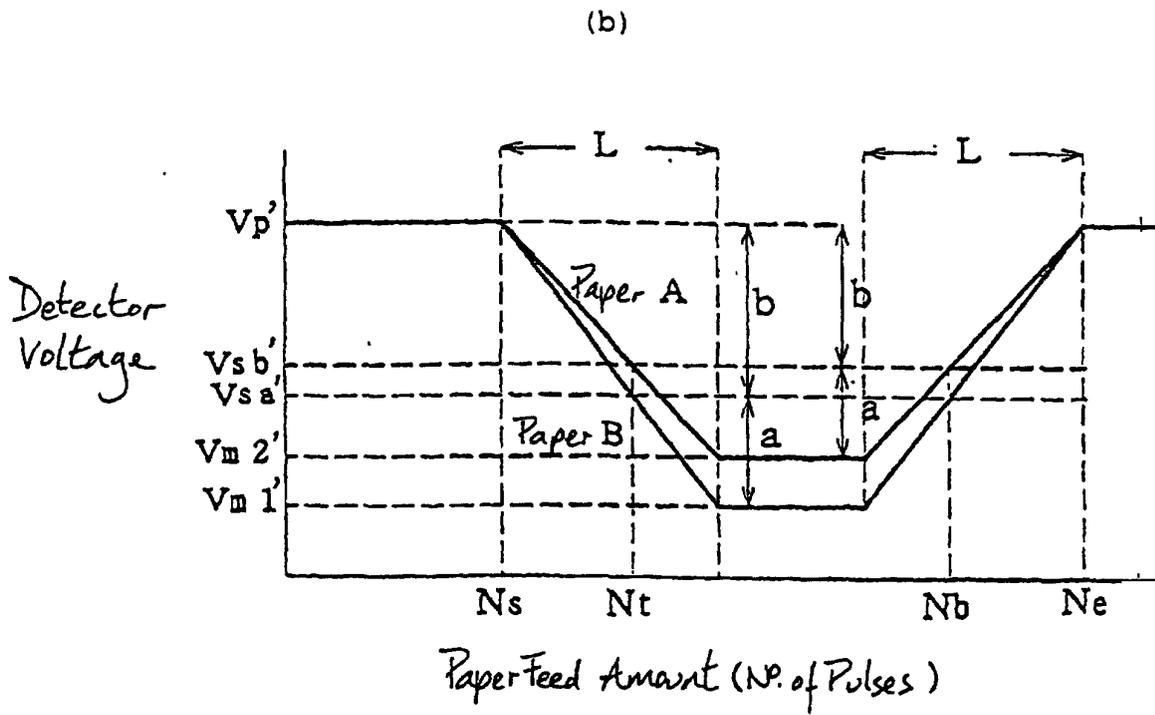
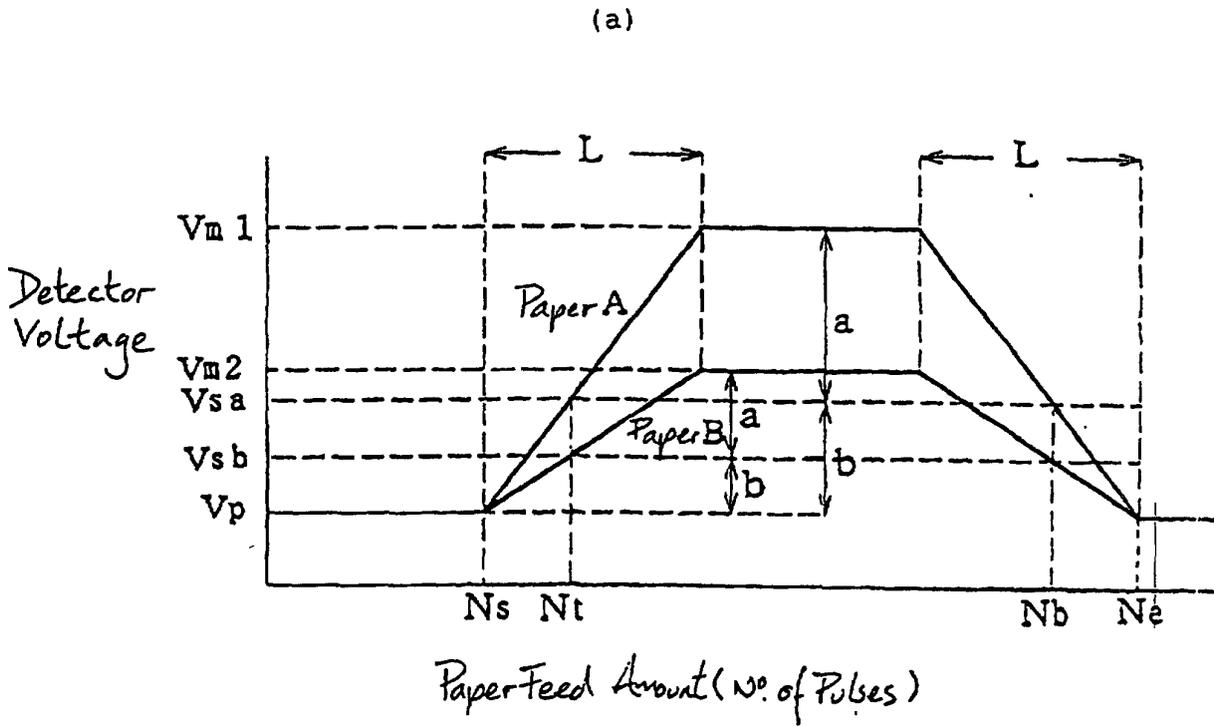
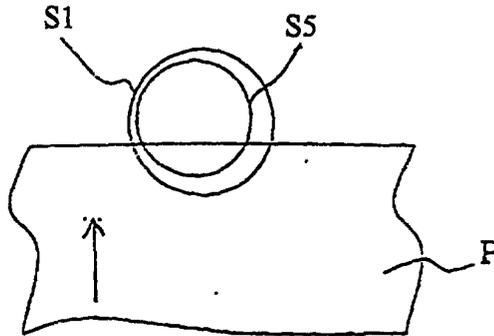


FIG. 6

(a)



(b)

