United States Patent

Colditz et al.

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[54] METHOD OF OBTAINING AND PROCESSING CONTROL DATA FOR ELECTRONIC PHOTOTYPESETTING APPARATUS

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** ..... **235/61.11 E**, 178/DIG. 3, 250/219 CR, 95/4.5 J, 340/146.3 Z

[51] **Int. Cl.** **G06k 9/18**

[58] **Field of Search** ..... 178/6 BW; 95/4.5; 235/61.115, 235/61.115 C; 250/219 CR; 340/146.3 Z

[56] **References Cited**

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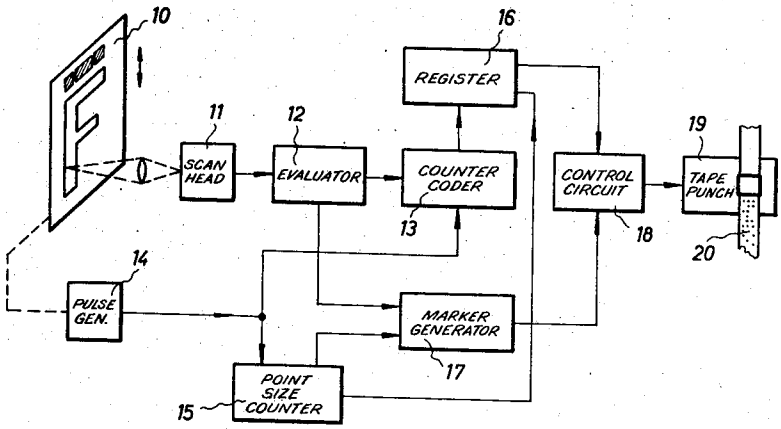
[57] **ABSTRACT**

A phototypesetting process in which a character original is provided with coded bars which extend from the initial image line of successively identical image lines to the next to the last of such identical image lines as a means of generating a mark which signifies identical information content of such lines. The information mark is utilized to provide a recall order corresponding to the number of repetitions of a single such information content which would reproduce the scanned portion of the character associated with each single mark. The utilization of such recall orders in combination with repetition counters significantly reduces the storage capacity required for storing data to reproduce the character original in that the recall marks are utilized to inhibit storage of successively identical information and to recycle such information as frequently as required in accordance with the character original.

4 Claims, 4 Drawing Figures



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SHEET 1 OF 4

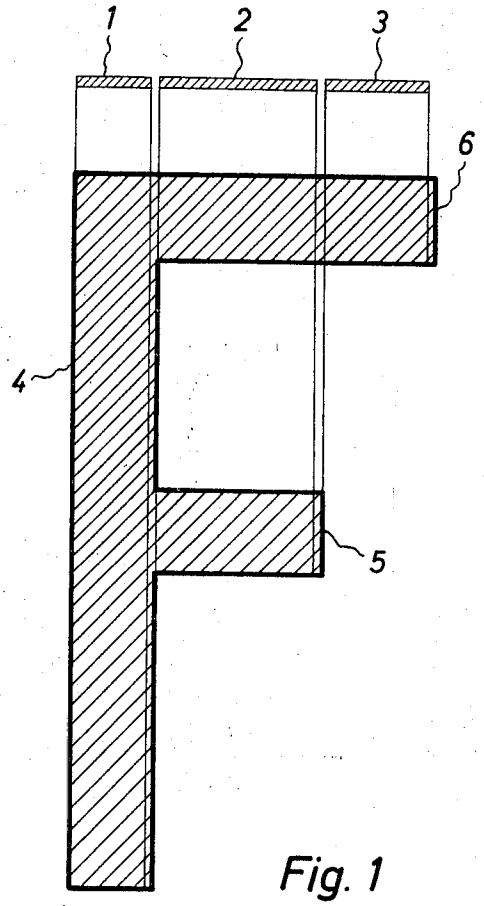

Fig. 1

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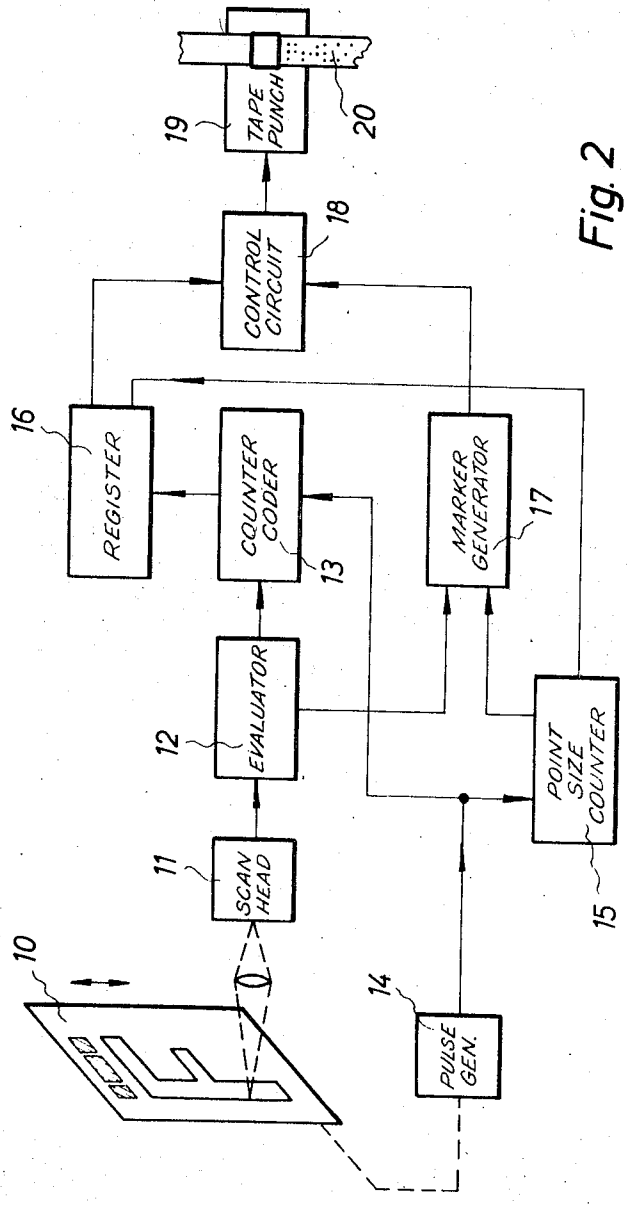

Fig. 2

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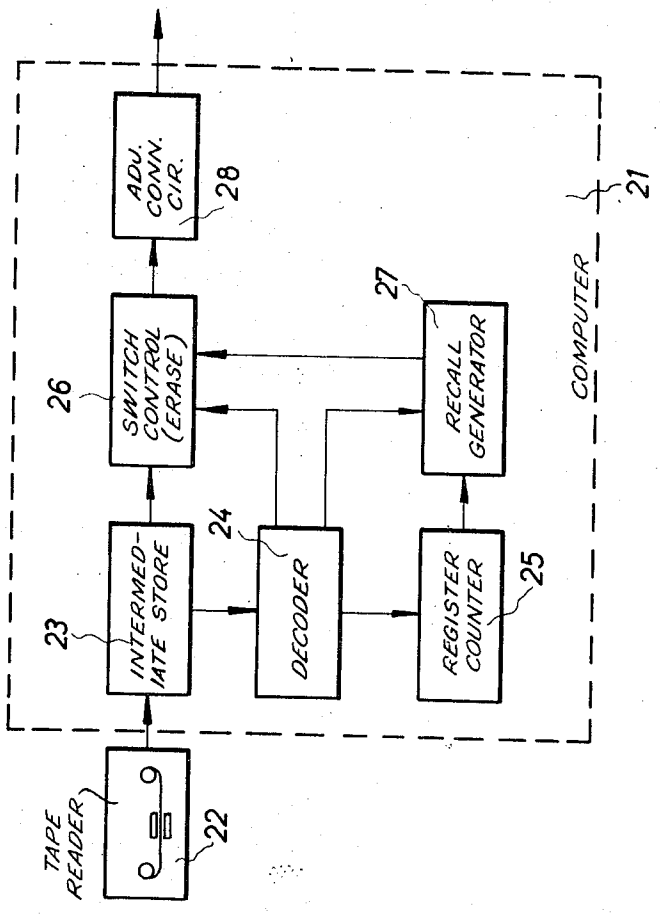

Fig. 3

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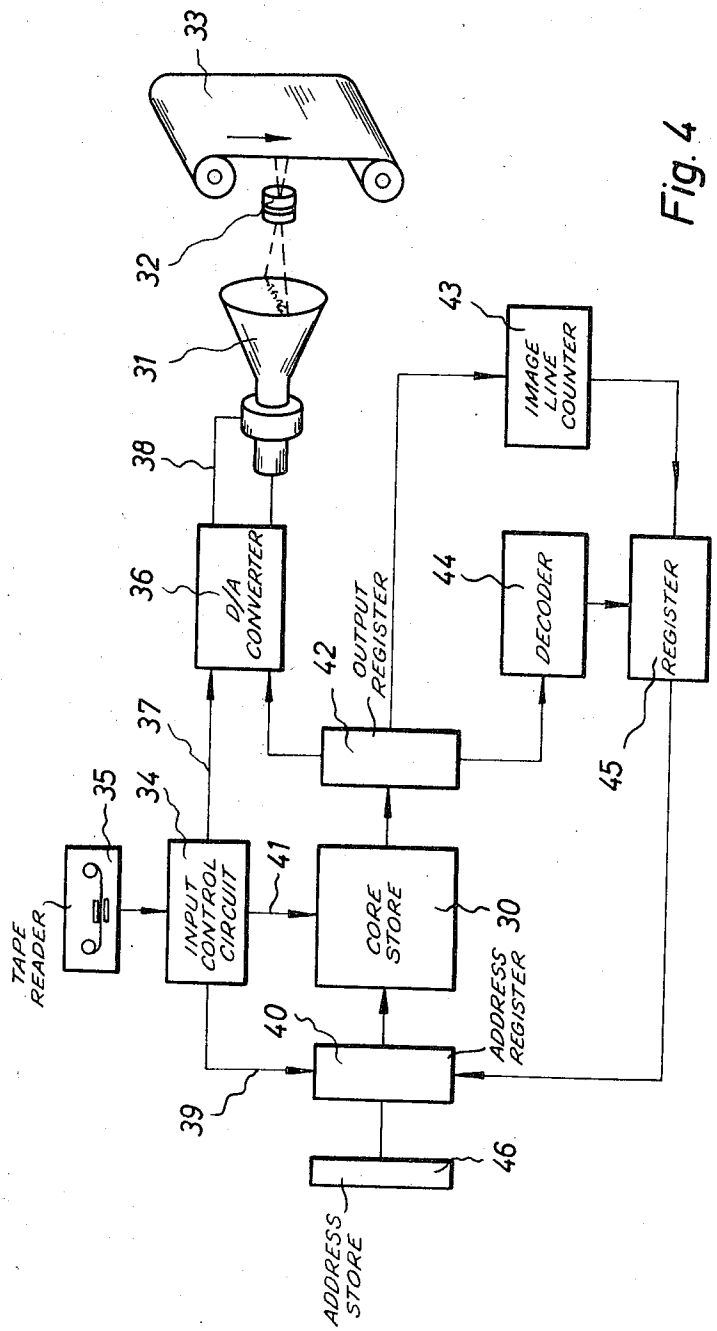

Fig. 4

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METHOD OF OBTAINING AND PROCESSING CONTROL DATA FOR ELECTRONIC PHOTOTYPESETTING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a method of obtaining and processing control data for electronic phototypesetting apparatus.

2. Description of the Prior Art

Heretofore, it was known to photoelectrically scan point-by-point and line-by-line a graphical character original for each of the characters to be set for the purpose of obtaining control data which determine the deflection and luminosity of the recording light ray, and to then associate a binary number corresponding to its length with each of the successive black and white image line portions by means of a coding device, and to store this binary data for the purpose of utilizing it as control data.

In order to store the binary data, ring core or wire stores are commonly employed because they facilitate quick access to the data. With respect to the necessary storage capacity, the following should be noted: for one character, often several hundred "bytes" (1 byte=8 bits) are required according to character, height, width, and the remainder of the character shape and the finest of the resolution of its contours. The necessary storage capacity for a single alphabet, for example, a German alphabet, which with its capital and small letters, numbers, punctuation and special marks contains altogether about 100 characters, is on the average, of the order of 10,000 bytes. However, printing generally requires that several alphabets must be available for one order, namely, for example, "bold face type," "thin face type" and "italics" of a particular type face.

It is therefore necessary to reduce the required consumption of storage capacity without however impairing the resolution of the contours of the characters.

It is an object of the invention therefore to obviate or minimize the above necessity, and the invention proceeds from the fact that frequently a row of adjacent image lines agree exactly in their information content, or in any case these lines are to be identically recorded in the typesetting process if they should have identical differences due to graphical inaccuracies on the character original, and the number of lines required will increase as the horizontal resolution becomes increasingly finer.

SUMMARY OF THE INVENTION

The invention proposes to solve the above problem by providing for at least several, and preferably for each, of the adjacent image lines having the same information content, with the exception of the last one to be scanned, a scannable marking in the character original in line with the image line, which on scanning produces a pulse which prevents the storage of data of a further image line which is the same as the latter and which furthermore induces the storage of orders for recalling the data of the first of these same image lines during the type setting process.

Since such markings relate to adjacent image lines, in practice each marking is represented as a continuous marking bar transverse to these image lines.

Advantageously, the obtaining of the recalling order is effected by causing the storage of a code combination associated with these markings by scanning each such marking. In the typesetting process, i.e., when recalling the data from the store, a register is advantageously set on a binary number corresponding to the frequency of the occurrence of the code combination allocated to the markings, and the pulses generated when this register is permutated are subsequently treated as recall orders. For example, each of these pulses is utilized for switching back the address register to provide the information content of an image line.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will become readily apparent and best understood by reference to the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 illustrates a character original of the capital letter F;

FIG. 2 is a block diagram illustration of apparatus for obtaining and processing control data for an electronic typesetting apparatus;

FIG. 3 is another block diagram of apparatus for obtaining and processing control data for an electronic typesetting apparatus; and

FIG. 4 is still another schematic block diagram of apparatus for obtaining and processing control data for an electronic typesetting apparatus.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, the character original according to FIG. 1 is provided above the letter F with three marker bars 1, 2 and 3. The marker bar 1 is allocated to the vertical stem 4 of the letter F, the marker bar 2 to the short, horizontal center bar 5 and to the superposed part of equal length of the uppermost horizontal bar 6, and the marker bar 3 finally to the remaining part of the bar 6 of the said letter F.

In explaining the present embodiment it assumed that the scanning of the character will be carried out, as usual, in vertical lines from the bottom to the top and beginning at the left-hand edge line.

The beginning of the marker bar 1 lies exactly in line with the left-hand edge of the vertical stem 4; its end, however, does not lie in line with the last image line but in line with the next to last one of the image lines pertaining to the stem 4, since in fact the last image line is no longer to be recalled.

The beginning of the marker bar 2 lies in line with the line on which both the horizontal bars 5 and 6 join with the vertical stem 4 and the marker bar 3 begins with the image line which follows on the end of the center bar 5. Also each of these marker bars 2 and 3 ends at the latest in line with the next to the last of the image lines of the respective bars 5 and 6.

With a very fine resolution, i.e., a larger number of image lines for each unit of length, the marker bars are terminated for safety about several image line widths before the last image line, rather than at the next to last image line.

The reduced and perspectively shown character original according to FIG. 1 has been given the reference 10 in FIG. 2. The character is scanned by means of an electro-optical scanning head 11. The electric pulses obtained hereby are then fed to an evaluating means 12 which ascertains whether the actual pulses are allocated to a black or white image line member. From there the pulses are fed to a counting and coding device 13, which allocates a binary number according to its length to every image line member.

A mechanical pulse generator 14 is controlled in dependence upon the relative movement between the character original 10 and the scanning head 11, which generator 14 times the counting and coding device 13 as well as a point size counter 15. This provides that when the total point size is scanned the binary numbers belonging to an image line are transferred from the counting and coding device 13 into a register 16. Should a scanning pulse occur above the full point size, this can then only be derived from a recall marker (1, 2, 3). These pulses are further passed on from the evaluating means 12 to a marker generator 17 and cause the marker generator 17 to produce a binary combination representative of the length of the recall marker and to supply a control means 18. It is insured by means of an AND circuit that the marker generator 17 can only function when the point size counter 15 has reached the number corresponding to the total point size. Previously, however, the information content of the register 16, namely the binary numbers of the image line members, was passed onto the control means 18 which controls the

tape puncher 19. The punched tape 20 is further processed in the part of the apparatus illustrated in FIG. 3.

The circuit blocks shown surrounded by the broken line in FIG. 3 together form a computer 21. Data retained in the punched tape 20 is then fed into an intermediate store 23 by means of a tape reader 22, which store 23 only receives one image line at a time. Provided that recall mark has been stored in addition to the temporarily stored image line, a pulse is initiated by the recall marker and fed into a marker decoder 24, which pulse advances a register counter 25 by a count of 1 and moreover causes a switch control circuit 26 to erase the data of the subsequent image line, since the function of such data is to be replaced by the recall order.

The register counter 25 is caused to count the marker pulses as long as they are occurring in uninterrupted succession. If the marker pulse once fails, this means that the data of the last of the equal image lines is being processed and the register counter 25 is reset to 0.

According to the number at which the register counter 25 has up to then been set to signify the number of the repetitions, a recall order is produced in a recall order generator 27 and added to the data of the image line to be recalled.

The control data prepared in this way are passed into a core store via an adjustment control unit 28.

The treating of the data obtained during film setting is described here following with the aid of FIG. 4.

The data output from the control apparatus 28 (FIG. 3) may have already been located in the core store 30.

So as to be able to use this data as control data for the phototypesetting device which consists more particularly of a cathode-ray tube 31, projection optics 32 and a film 33, the necessary setting instructions are forwarded to the input control device 34. In the present case these latter instructions originate from the data tape which on the one hand was established by means of an appropriately programmed computer (not shown) and whose data are read out by means of the tape reader 35 and passed on to the input control apparatus 34.

Since all of the control data are used in binary form, they must be converted into analogue control signals by means of a digital-analogue converter 36 before being fed into the phototypesetting device.

Certain setting instructions, as, for example, the positioning control of the electron beam, are directly fed to the cathode-ray tube 31 via lines 37, 38, i.e., not by recall from the core store 30.

The address of the actual information to be recalled from the core store 30 is passed into an address register 40 via a line 39 and the actual information recall relating to an image line member is fed into an output register 42 by way of a line 41 and the store 30. So far as it is a question of one image line to be recalled, the addresses of the information to be recalled are transferred simultaneously into an address store 46.

The information arriving from the output register 42 in the phototypesetting apparatus is simultaneously passed onto an image line counter 43 which is constructed to recognize the actual end of the image line and is operated to currently retain the number of the image lines completed.

Furthermore, a decoder 44 singles out the information from the actual number of repetitions and sets a register 45 at this number.

The image line counter 43 counts off or empties the register 45 which provides a pulse to the address register 40 for each completed image line, which pulse causes the addresses present in the address store 46 to be again forwarded to the address register 40 and at a frequency which corresponds to the number at which the register 45 has been set.

Generally then, there has been described herein apparatus for recording information on a punched tape or the like wherein a character original is scanned line-by-line and point-by-point by an optical scanning head which generates electrical signals according to the black and white content sensed during the scan, which content is evaluated and fed to a counter-decoder. A mechanically operated pulse generator is linked to the carrier of the character original and is effective to advance the counter-coder and to advance a point size counter simultaneously therewith. The scanned character original includes a character having a bar code superimposed thereabove at the terminal extent of each line image scanned to designate the termination of substantially identical previous scans and the initiation of a new series of scans having identical information content.

When the predetermined character height has been scanned, as indicated by the point size counter, the information content of the counter-coder is passed to a register and then to a control circuit for a tape punch. Should a scanning pulse occur above the full point size of the character, this occurrence is read as a recall marker and is effective in combination with its location as determined by the point size counter to cause a marker generator to supply the tape punch control circuit with a binary combination allocated to that recall marker.

The punched tape is read into a core store in one instance by way of a computer which includes apparatus for recognizing the binary combinations of the recall markers and erasure of subsequent image line data upon the occurrence of recall markers. The computer further includes apparatus for counting the number of occurrences of any particular recall marker and to subplant this number with a recall order to be provided with the data content associated with the particular recall markers for storage therewith in the core store.

The storage of information in the core store includes the generation of addresses for each separate set of data, storage of the data in the store at those addresses and storage of the addresses in an address store. The store is provided with an output register which presents the information to be set to a digital-analogue converter for utilization by a cathode-ray tube. In addition, a decoder recognizes the recall information for successive identical scans and sets a register to the number of required repetitions of such scans, which register is permutated by an image line counter which is operated by the output register. This effects a recycling of the address register so long as repetition of data content is to be fed to the digital-analogue converter.

Many changes and modifications may be made in the invention by those skilled in the art without departing from the spirit and scope thereof, and such changes and modifications should be included within the scope of the invention as defined in the appended claims.

What we claim is:

1. A method of obtaining and processing control data for electronic phototypesetting apparatus wherein a character original is photoelectrically scanned image line by image line and point-by-point within each image line and a binary number is generated by means of a coding device in response to the successive black and white image line members of the character original scanned, which binary data is stored for use as control data, comprising the steps of disposing a scannable recall marking adjacent the character original in line with an image line and extending across at least several of the adjacent image lines which have the same information content as the mentioned image line, scanning the recall marking during scanning of the character original to produce a recall pulse, inhibiting with the recall pulse the storage of data of a further image line having the same information content as the precedingly scanned image line, and storing recall orders in response to the recall pulses for recalling the data of the first of the identical image lines during the setting process.

2. A method according to claim 1, wherein the step of providing the scannable recall marking is further defined as providing the scannable recall marking for each of adjacent image lines extending from a position in line with the first of the image lines to the next to the last one of identical image lines.

3. A method according to claim 1 comprising the step of storing a respective code combination for each of the scannable recall markings.

4. A method according to claim 3 comprising the step of registering a binary number corresponding to the frequency of the occurrence of each code combination allocated to the markings in a register, and permutating the register to recall image line information from the data store in accordance with the binary number code combinations.

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