United States Patent

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[54] **SYSTEM AND METHOD FOR MAKING UP A NEWSPAPER PAGE**
1 Claim, 3 Drawing Figs.

[52] **U.S. Cl.** **340/172.5, 95/4.5**
[51] **Int. Cl.** **G06f 7/10**
[50] **Field of Search** 340/172.5; 235/151.22; 197/20; 95/4.5

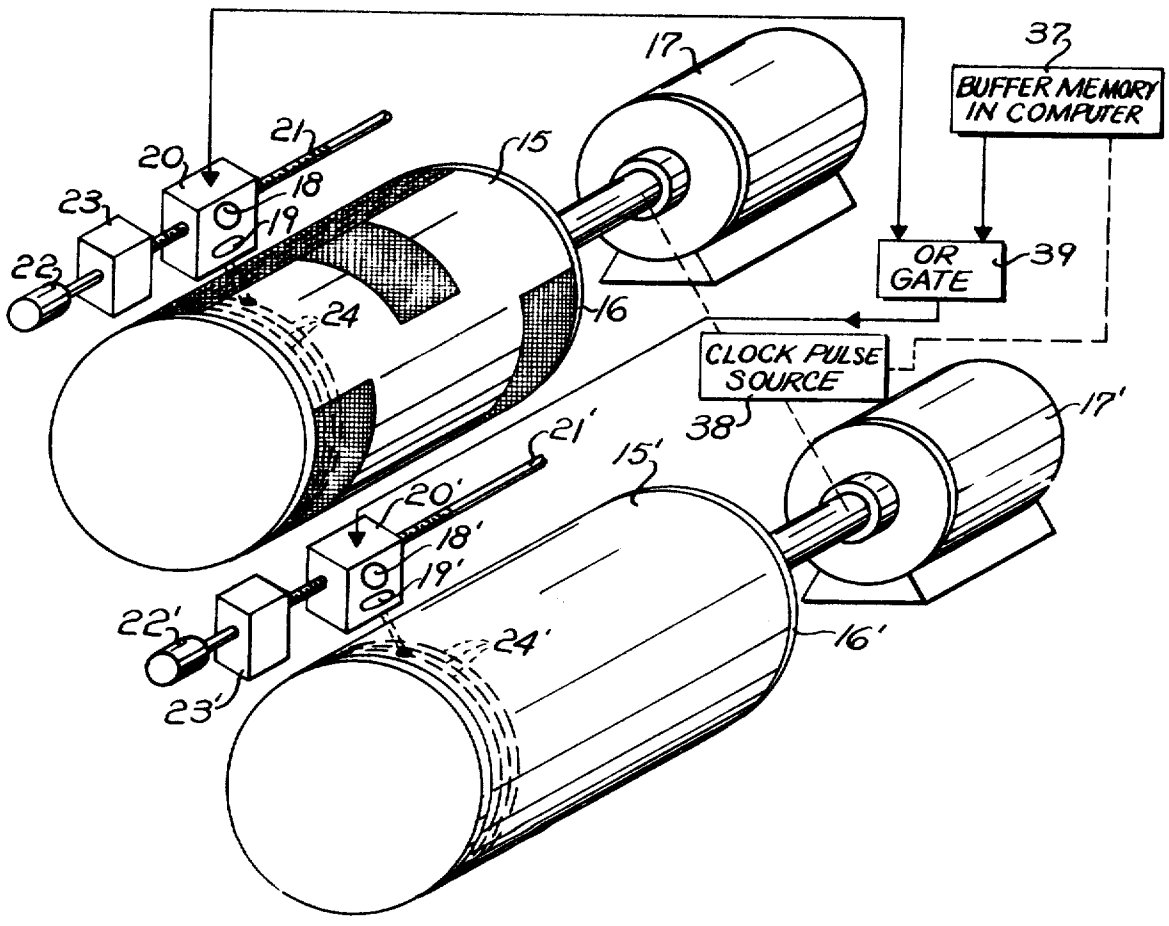
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ABSTRACT: In the present system and method a photographic scanning recorder is controlled alternately by a scanning transmitter and a digital computer. The scanning transmitter scans a master page displaying material such as large headlines, pictures and advertisements. The digital computer processes story texts allocated to the remaining column spaces on the page. The computer provides column justification of its "raw" story text input, storing in its memory the coded identity and page location of each typographic character in the story text. Also stored in the computer memory are character-generating data for every typographic character that may appear in the text. The computer scans its memory electronically in accordance with the scanning operation of the photographic recorder to provide binary output signals to the recorder which cause the latter to record narrow segments of the typographic characters at the proper locations on the page. During one complete scanning of the record page in the photographic scanning recorder, both the material read from the master page in the scanning transmitter and the story texts are recorded on the record page in the recorder.



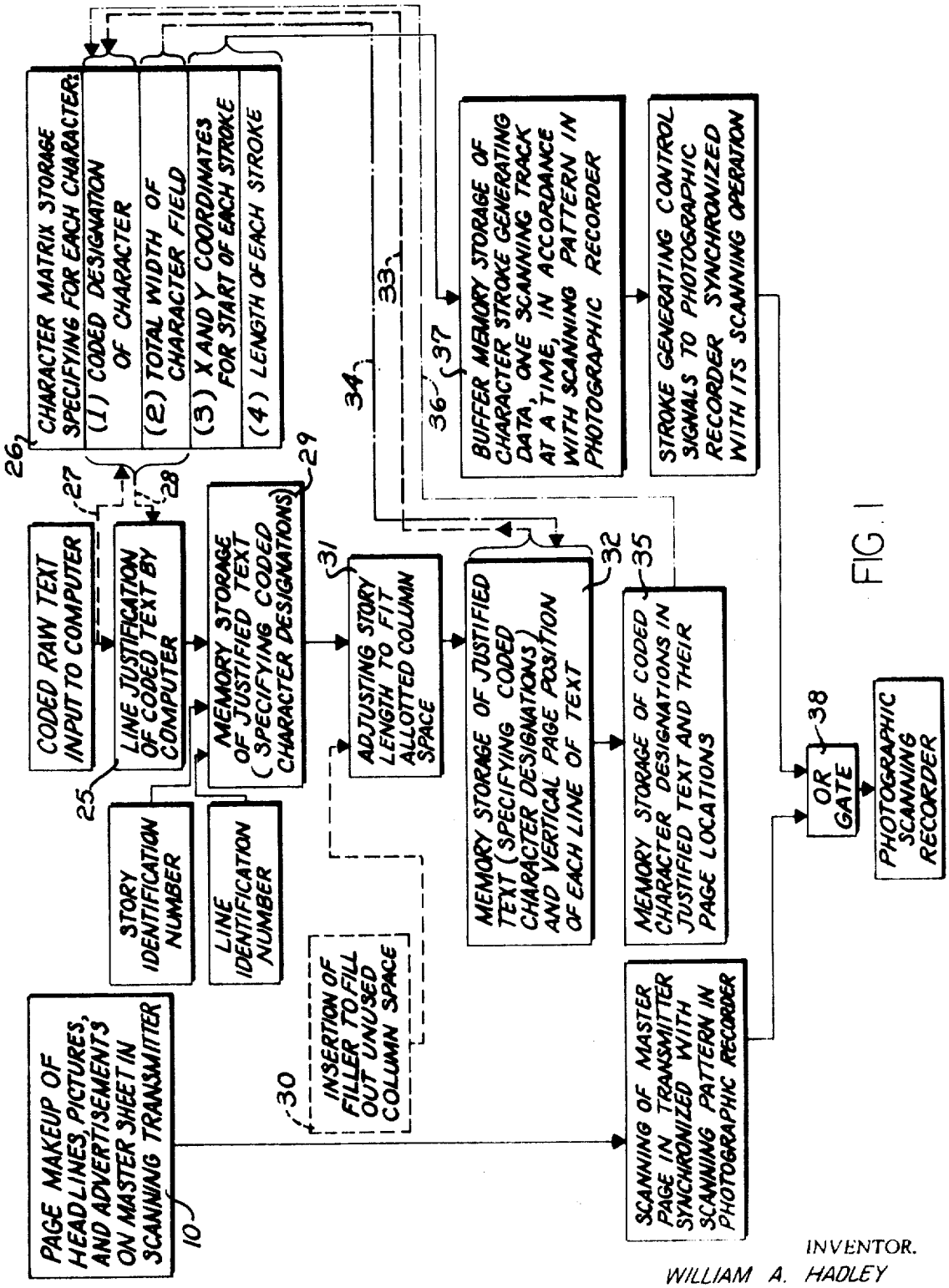


FIG. 1

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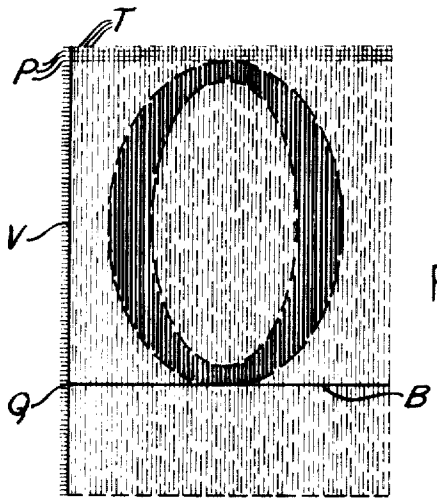


FIG. 2

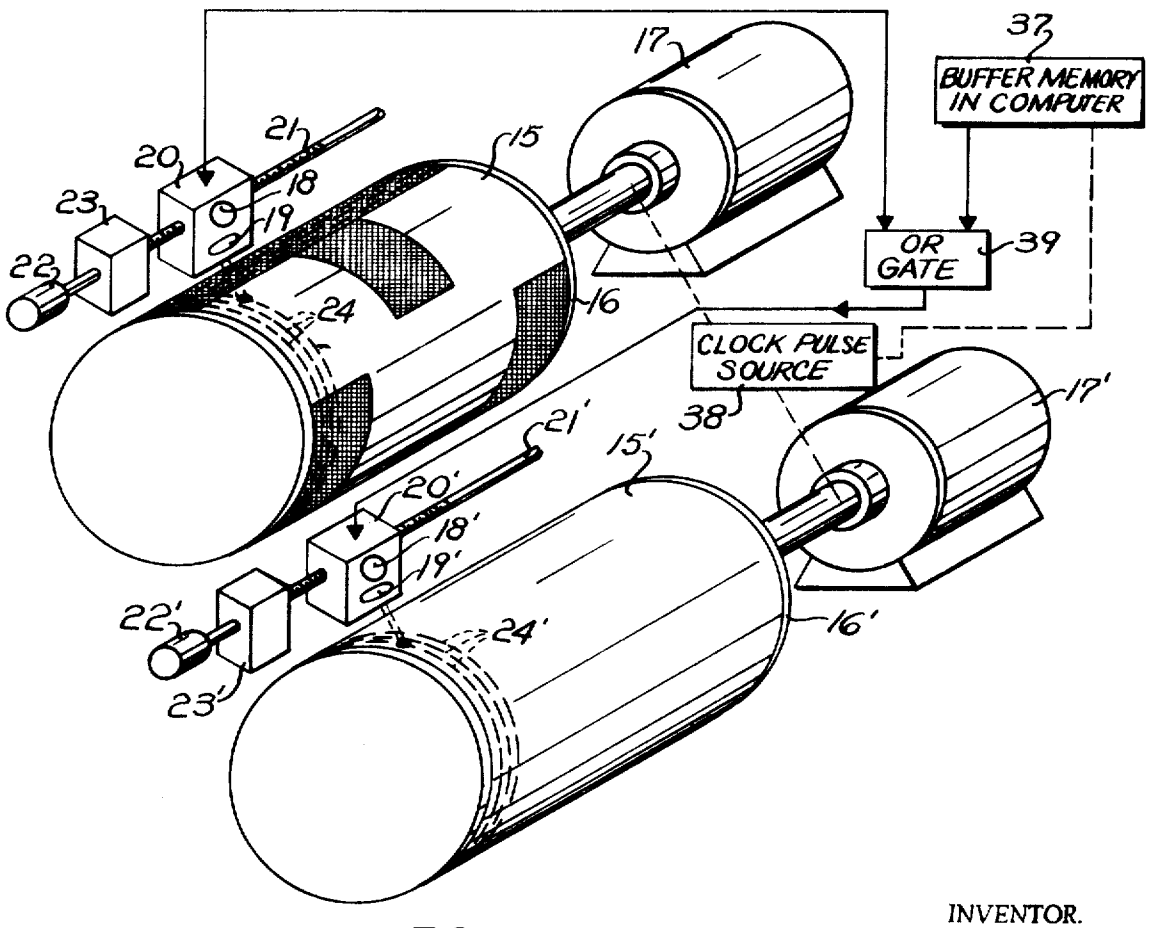


FIG. 3

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SYSTEM AND METHOD FOR MAKING UP A NEWSPAPER PAGE

This invention relates to a system and method for making up a newspaper page.

One facsimile-type system now in use for newspaper printing provides a transmitter having a master copy of the complete printed page wrapped around a motor-driven drum. This master copy is scanned photoelectrically along a continuous helical path composed of side-by-side, narrow scanning tracks, each extending almost vertically on the page. The system has a receiver, which may be located remote from the transmitter, having a photographic film wrapped around a motor-driven drum whose rotation is synchronized with that of the transmitter drum. A light source at the receiver scans a similar helical track on the film, and this light source is flashed in accordance with the output signals from the photoelectric device at the transmitter, so as to reproduce on the film at the receiver a facsimile or replica of the master page at the transmitter.

In the copending U.S. Pat. application Ser. No. 753,680 to Dong W. Lew and Ralph A. Proud, Jr., filed Nov. 26, 1968, there is disclosed and claimed a computer-controlled system and method for recording line-justified text.

The present invention is directed to a novel system and method for making up a newspaper page by combining in a novel and advantageous manner the above-described facsimile technique and the just-mentioned technique of recording text material under the control of a computer.

Briefly, the present invention contemplates using this facsimile technique for recording the large headlines, pictures and advertisements that are to appear at predetermined locations on a newspaper page and using the computer-controlled technique for recording the story texts in the remaining column spaces on the page to which they have been assigned by the editor. This is done during a single complete scanning of the record page at the receiver of the facsimile system by connecting this receiver either to the output of the transmitter or to the output of the computer, depending upon the instantaneous scanning position, so that the recording of the large headlines, pictures and advertisements will be interspersed with the recording of the story texts. In this manner the present invention optimizes the different advantages of both the facsimile-type recording technique and the computer-controlled recording technique, using the former for recording the material which is normally completely prepared in the initial makeup of the newspaper page and using the latter for recording the story texts, principally news stories, which are normally inserted later.

Accordingly, it is a principal object of this invention to provide a novel and improved system and method for making up a complete newspaper page by using a scanning transmitter and a computer to control alternately the operation of a photographic scanning recorder.

Another object of this invention is to provide such a system and method in which the scanning transmitter is used to control the recording of the material which is normally decided upon first in the page makeup, such as large headlines, pictures and advertisements, and the computer is used to control the recording of story texts which are normally inserted later in the page makeup.

Another object of this invention is to provide computer-controlled column justification of story texts in the makeup of a newspaper page.

Further objects and advantages of this invention will be apparent from the following detailed description of a presently preferred embodiment, which is illustrated schematically in the accompanying drawings.

In the drawings:

FIG. 1 is a flow sheet illustrating in general outline the operation of the present system and method;

FIG. 2 is a view depicting schematically the matrixlike rectangular field of a typographic character; and

FIG. 3 is a schematic view illustrating the operation of the photographic scanning recorder from the scanning transmitter and the output of the computer in the present system.

In conventional newspaper practice, the page layout of the large headlines, photographs and advertisements is done in advance of the insertion of the story texts on the page. The story texts are inserted in the column spaces left over after the space allocations have been made for large headlines, photographs and advertisements in accordance with the newspaper's particular style. The editor estimates the lengths of the various story texts and places them accordingly on the page in the leftover column spaces. If the story text assigned to a particular space is too short by a very few lines, the printer may lengthen it out along the column by leading between the lines to spread the lines of print farther apart. If the story text is too short by several lines, a short filler report or story with an appropriate small headline may be added below the story text to fill out its assigned column space.

In the present system and method, the page layout of the large headlines, photographs and advertisements may be performed, either by hand or by a known phototypesetting technique, on a master sheet for use in the transmitter of a known type of facsimile scanning printer system, such as the "Pressfax" system sold by Westrex Communications, Division of Litton Industries, New Rochelle New York. Referring to Fig. 3, after this partial page layout has been completed, the master page 15 will have certain spaces assigned to the large headlines, photographs and advertisements, as indicated by the shaded areas in this figure. The remainder of the master page 15 is blank.

The master page 15 is wrapped around a cylindrical drum 16 in the transmitter of the scanning printer. This drum is driven by an electric motor 17, which provides step-by-step increments of rotational movement of the drum periphery, such as 0.001 inch. A photoelectric cell 18 reads the black or white condition of a small incremental area of the master page 15 through a lens system 19.

The photocell 18 and its lens system 19 are mounted in a housing 20 which is threadedly coupled to a lead screw 21 extending along the axial length of the drum 16 parallel to the latter's rotational axis. Lead screw 21 is driven at an extremely slow speed from an electric motor 22 through reduction gearing 23 such that the photocell 18 is displaced to the right axially along the drum 16 a very short distance (e.g., 0.001 inch) for each rotation of the drum. Consequently, the photocell scans a continuous helical path of substantially vertical tracks 24 which are closely spaced horizontally across the master page 15. The spacing between these tracks is greatly exaggerated in Fig. 3 for clarity.

At the receiver-recorder of the scanning printer a similar scanning arrangement is provided, corresponding elements of which have the same reference numerals as the elements of the transmitter, with a "prime" suffix added. Element 18' in the recorder, instead of being a photocell, is a light source which is adapted to flash a small spot of high intensity light through the lens system 19' onto the incremental area of the photosensitive film page 15' which is then directly opposite the light source.

The drum motors 17 and 17' and the lead screw motors 22 and 22' at the transmitter and the recorder, respectively, are synchronized with each other so that the rotational positions of the pages 15 and 15' will be the same at any instant, as will the positions of the photocell 18 in the transmitter and the light source 18' in the recorder with respect to the pages.

In accordance with the present invention, the master page 15 in the transmitter is reproduced photographically on the page 15' in the recorder only for those portions of the page (shaded in Fig. 3) where the large headlines, photographs and advertisements are located, and at the remaining column spaces the story texts are recorded photographically on page 15' in the receiver under the control of a digital computer, as now to be explained.

Referring to the flow chart of Fig. 1, in the computer-controlled portion of the present system, the so-called "raw" story

text in binary-coded digital form (for example, the punched tape or magnetic tape output from a keyboard-operated device of known design) is fed into a general purpose digital computer. This "raw" text is composed of a sequence of groups of binary digits designating typographic characters, including letters and numbers, arranged to provide a series of text words, with spaces between the words and proper punctuation, corresponding to the text to be recorded.

The digital computer is programmed by any suitable known technique, the details of which are not part of the present invention, to rearrange this "raw" text into a series of successive justified lines which will appear as horizontal lines of type spaced apart vertically one after the other in the selected column on the final printed page. The computer justifies each such line by providing the proper word spacing to fill out the line, the beginning and end of each line, and any word hyphenation which may be necessary at the end of a line. This justification step is indicated by the block 25 in Fig. 1. In this line justification process the computer will insert after each word an interword space code and one or more digital codes designating the actual size of the interword space.

In this justified text stored in the computer, the different characters are specified merely by their respective coded designations, which are not capable of generating the strokes or segments which compose the character. For this latter purpose, the computer memory stores a plurality of character-generating matrices, each containing the digital information from which the corresponding typographic character may be generated.

The complete newspaper page on which the text is to appear may be considered as a rectangular major matrix composed of a series of closely spaced, substantially vertical coordinate lines and a series of closely spaced horizontal coordinate lines at closely spaced "dot" locations. In one practical embodiment, there may be 800 to 1000 dot locations (or coordinate intersections) per inch in both the horizontal and vertical directions on the page.

The position on the page of any given line of print may be designated by specifying the location horizontally across the page of the left-hand margin, or start, of the line of print and the location vertically on the page of the horizontal base line of the line of print.

Referring to Fig. 2, each letter or number character in a typographical font may be regarded as being contained within the outline of a rectangular field, which is bounded by the dashed lines in this figure. This character field constitutes a minor matrix which may occupy a particular location on the major (page) matrix.

Each character field has a horizontal base line B, which will coincide with the base line of the line of print in which that typographic character appears, and a substantially vertical side reference line V located at the left side edge of the field. The intersection between the base line B and the side reference line V constitutes a reference point Q for the complete character field.

All decimal numbers, all capital letters and most lower case letters are located entirely above the horizontal base line B, but some lower case letters, such as "y", have depending portions which extend below the base line. However, in all cases each number or letter character is contained entirely within the minor matrix constituted by its rectangular field. The respective fields for the different letters and numbers have the same vertical height, but they differ in their respective horizontal widths in accordance with the width of the character itself.

Referring to Fig. 1, the character matrix memory storage 26 in the computer contains all the information necessary to generate individually the respective character field of every typographic character which might possibly appear in the text, and for every size and style of type which may be selected.

Referring to Fig. 2, as an illustrative example, the capital letter "O" is shown within its rectangular field which, as stated, will constitute a minor matrix within the major (page) matrix. This character matrix may be regarded as being composed of a series of closely spaced, substantially vertical tracks T, which occur in evenly spaced succession horizontally from left to right across the field, and a series of vertically spaced, horizontal intersections on each track T. For convenience of illustration, in Fig. 2 only the first three horizontal intersections at the top of the field are designated by the horizontal lines P. The remaining horizontal intersections are designated by the short lines to the left of the side reference line V. The almost-vertical tracks T and the horizontal intersections P in the character field correspond to certain of the intersecting coordinate lines on the major (page) matrix. The entire character field may be "scanned" in raster fashion by proceeding in succession down each of the vertical tracks T through each of horizontal intersections P in succession.

The horizontal and vertical coordinates of the beginning (i.e., upper end) of each vertical stroke which forms a narrow line segment of the character (indicated by the heavy lines in Fig. 2) may be specified by a number designating its Y coordinate distance from the base line B and a number designating its X coordinate distance from the left-hand edge V of the character field. Along with this coordinate information on its starting position, the length of the stroke may be specified in terms of the number of successive coordinate positions P along a vertical track T which it occupies in the character field. The coordinates of its starting point and the length of the stroke constitute all the information necessary to generate the stroke.

The character matrix storage 26 contains, in addition to the data specifying the X and Y coordinates for the start of each stroke in the character and the length of the stroke, a coded designation of the typographic character and data specifying the total horizontal width of the field of that character. As already stated, this width will be different for different typographic characters.

In the already-mentioned line justification of the coded text, the computer refers to its character matrix storage for the character field width of each character whose coded designation appears in the text by first matching each character code designation appearing in the raw text with the corresponding character code designation in the character matrix storage 11, as indicated by the dashed line 27 in Fig. 1, and then determining from the latter the character field width for controlling the line justification operation, as indicated by the dashed line 28.

The line-justified text, still containing only the coded designation of the characters and not the character-generating data, is stored in the computer memory, as indicated by the block 29 in Fig. 1. At this time a story identification number is added at the beginning of the text story, and a line identification number is added at the beginning of each line of the justified text, these story and line identification numbers being stored in the memory along with the line-justified text.

Next, in accordance with the present invention, the computer compares the column length of the justified story text against the column space which had been allotted to it by the editor in his page makeup and then encoded into the computer by an operator. The column length which would be occupied by the justified story text is obtained by counting the number of text lines in the story, assuming initially a known even spacing between successive lines throughout the story.

If the story text is longer than the allotted column space, the computer will stop and signal the operator since this situation will require a decision by the editor to either relocate the story or delete part of it.

If the story text is shorter than the allotted column space by one or two lines, the story text will be reprocessed by the computer to increase the spacing between lines in order to fill the allotted column space. This can be done conveniently by adding a few points of "leading" in code form after the coded designation indicating the end of each line. This can be done by inserting a coded designation of the position vertically on the page of the base line of each line of the story text. However, this is not absolutely essential so long as the vertical page

position of the first line of the story text is designated, along with the vertical spacing between successive lines.

If the story text is too short by more than a minimum amount, such as two lines, the computer will look to its memory for a short filler to occupy the leftover space, as designated by the dashed-line block **30** in Fig. **1**.

A combination of increasing the line spacing and adding a filler story may be used where the principal story is too short for its allotted column space.

The various operations involved in adjusting the length of the story text to match the allotted column space are designated schematically by the block **31** in Fig. **1**.

At the completion of the story length adjusting operations, the vertical page location of the base line of each line of the story text is stored in the computer memory, along with the coded designations of the various typographic characters appearing in the story text, as indicated by the block **32** in Fig. **1**.

The binary output signals from the computer which control the operation of the scanning receiver are obtained by processing the information contained in the different sections **32** and **26** of the computer memory as follows:

First, there is added to the justified character code text (block **32**) the data designating the horizontal location of each character matrix field along each line of the text. This is done by matching each encoded character designation appearing in the justified text in the memory section **32** with the corresponding character code in the character matrix storage **26**, as indicated by the dashed line **33** in Fig. **1**. Then, from the information on the total width of this character matrix, which is contained in the memory section **32**, the computer determines the position horizontally along the line of justified text of the reference point Q of the character matrix field for each character appearing in that line of text, designating this position digitally, as indicated by the dashed line **34** in Fig. **1**.

The computer now has stored in its memory, as indicated by the block **35** in Fig. **1**, the following information on the justified story text:

1. the vertical position on the page of each horizontal line of the text;
2. the coded designations of the typographic character in the lines of print; and
3. the respective horizontal positions of the typographic characters along the lines of text in which they are to appear.

It will be evident that the page location of the reference point Q of every character field matrix on the major (page) matrix is completely defined by specifying the Y coordinate position on the page matrix of the line of text in which that character appears and the X coordinate position along that line of this reference point Q for the character field matrix.

With the encoded characters and their page positions having been stored in the computer memory, as indicated by block **35**, the characters themselves may be generated, one vertical stroke at a time down through the successive lines of text, in accordance with the sequence of the scanning lines **24'** in scanning receiver (Fig. **3**), by reference to the data in the character matrix storage (block **26**, Fig. **1**) which specify:

a. the X and Y (horizontal and vertical) coordinates for the start of each vertical stroke with respect to the reference point Q for that character field; and

b. the length of each vertical stroke.

The computer scans through the information contained in its coded character storage memory **35** in accordance with the scanning tracks **24'** to identify each typographic character and its page position. Then, by matching the selected character in block **35** with the corresponding character code in memory block **26**, as indicated by the dashed line **36** in Fig. **1**, it determines from the latter the data on the X and Y coordinates for the start of each stroke and the length of each stroke in the character. This processing provides the following information for storage in a buffer memory in the computer, as indicated by the block **37** in Fig. **1**:

1. a coded designation of the page position of the reference point Q of each character field;
2. a coded designation of the X and Y coordinates of the start of each vertical stroke necessary to make up the character, these coordinates being specified with respect to the reference point Q for the field of this character; and
3. a coded designation of the length of each stroke, expressed as the number of vertically spaced coordinate positions P during which the light source **18'** in the scanning receiver is to remain on (or off).

Preferably, in order to minimize the required capacity of this buffer memory, this information is stored for only one vertical page scanning track **24'** at a time, or for only a fraction of one scanning track. Preferably, also, this buffer memory is a rapid access memory, such as a magnetic disc or core memory, in which the information for one scanning track, or part of a scanning track, is stored by parallel input to control all the character strokes which are to occur in that scanning track. This buffer memory provides a serial output of successive binary signals which are synchronized with the drive motor **17'** in the scanning receiver so that the binary signals applied to the light source **18'** will correspond to its instantaneous page position along a particular scanning track **24'**.

Preferably, the storage of these binary signals in the buffer memory, in response to the described processing of the data contained in the computer memory sections designated by blocks **35** and **26**, takes place ahead of the corresponding scanning position of the light source **18'** along the scanning tracks. However, the readout of these signals to control the energization of light source **18'** is synchronized with the latter's scanning position. Such synchronization may be provided by a clock pulse source **38** (Fig. **3**) which produces a control signal at each incremental rotation position of the drum **16'** for causing the buffer memory in the computer to deliver the next binary output signal to the light source **18'**.

Both the output from the scanning transmitter and the output from the computer pass through an OR gate **39** to the input of the scanning receiver. This OR gate is conditioned to pass the output signals from the scanning transmitter when the photocell **18** in the latter is scanning a portion of the page allocated to large headlines, pictures or advertisements, and to pass the output signals from the computer when the photocell is scanning a portion of the page allocated to story texts. For example, the OR gate may be normally conditioned to connect the scanning transmitter to the scanning receiver, and then in response to the reading of the story identification number at the beginning of a story text it disconnects the scanning transmitter from the scanning receiver and connects the computer output to the scanning receiver.

From the foregoing it will be evident that the present invention makes use of the facsimile scanning technique to record the page material decided upon first, such as advertisements, pictures and large headlines, and whose page makeup may be advantageously prepared by known techniques. The present invention also makes use of the rapidity, economy and precision with which story texts may be recorded under the control of a digital computer. The scanning recorder is controlled alternately by either the scanning transmitter or the computer, depending upon the instantaneous page-scanning position, so that all of the material is properly recorded during one complete scan of the record page in the receiver.

While a presently preferred embodiment of this invention has been described with reference to the accompanying drawings, it is to be understood that the invention may be embodied in arrangements differing from the particular embodiment disclosed without departing from the scope of the present invention. For example, the scanning in the transmitter and the recorder may be along the lines of print, instead of substantially perpendicular to them, as disclosed.

I claim:

1. A method of making up a newspaper page comprising the steps of preparing a master copy of a newspaper page having at predetermined locations thereon material to be reproduced and having a blank space for text at other predetermined page locations, scanning the master copy along scan lines which run

the extent of the page in one direction, operating a reproducing recorder to scan photographic material in synchronism with the scanning of the master copy, controlling the reproducing recorder from the scanning transmitter to reproduce the master copy material while it is being scanned by the scanning transmitter and controlling the recorder from a computer having text material stored therein to reproduce text material on the photographic film while the transmitting recorder is scanning blank spaces.