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[21] Appl. No. 650,418
[22] Filed June 30, 1967
[45] Patented Sept. 22, 1970
[73] Assignee Crosfield Electronics Limited,
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[32] Priority July 6, 1966
[33] Great Britain
[31] 30,375/66

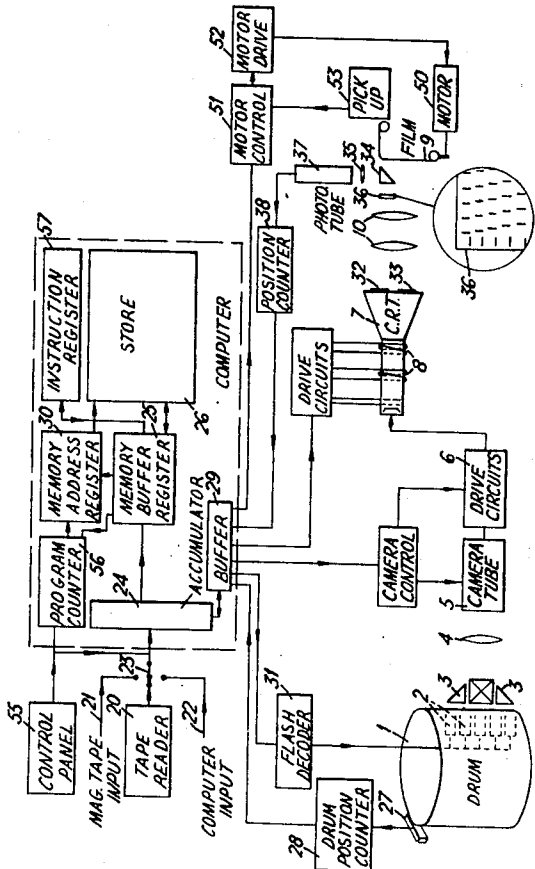
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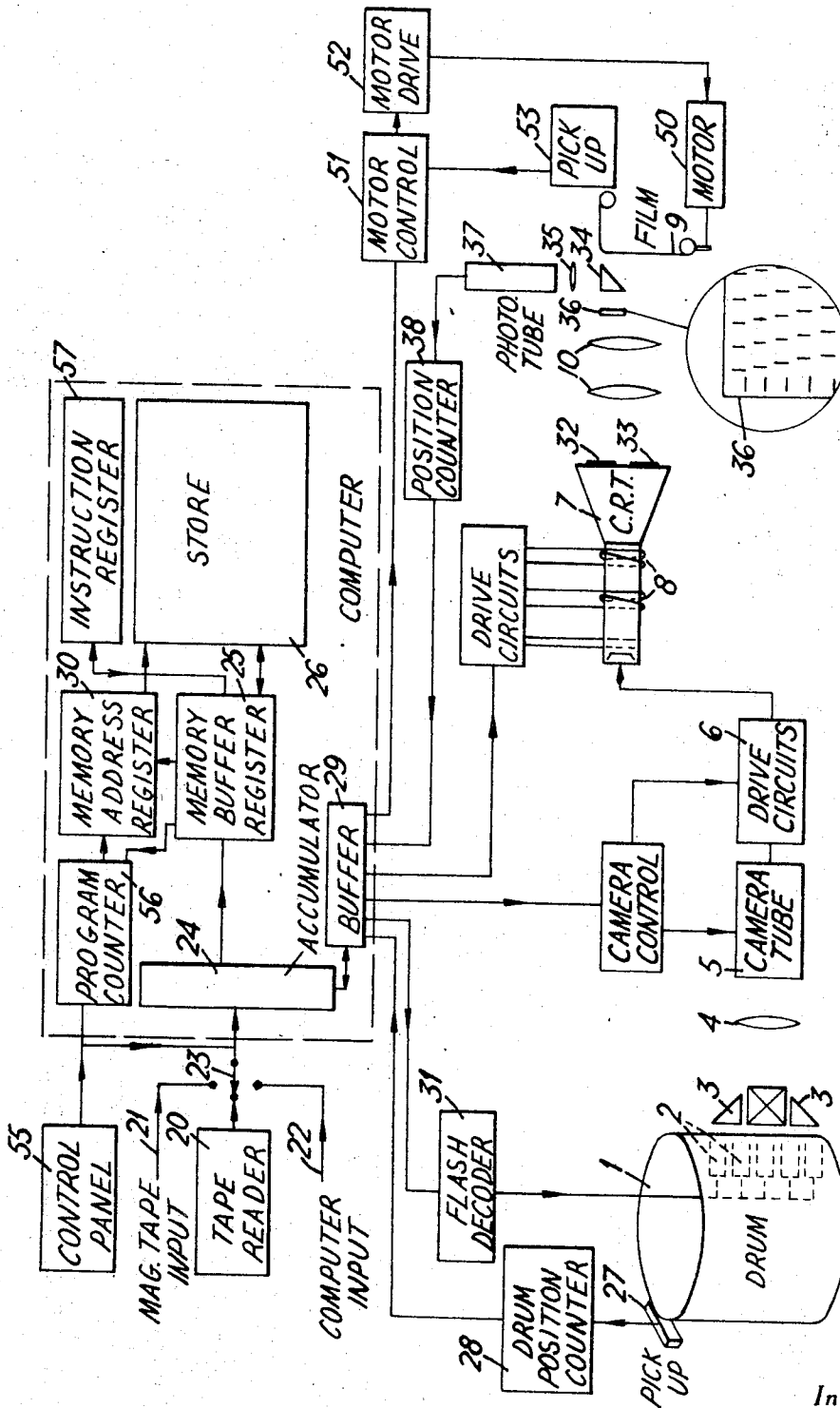
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[54] PHOTOGRAPHIC TYPE COMPOSING
8 Claims, 1 Drawing Fig.
[52] U.S. Cl..... 95/4.5
[51] Int. Cl..... B41b 19/00
[50] Field of Search..... 95/4.5

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ABSTRACT: In a photocomposing system, when a required character on a continuously rotating character matrix reaches an exposure position, a flash tube projects the character onto the storage screen of a camera tube. The storage screen is scanned to provide a video signal representing the required character and simultaneously scanning deflection potentials are applied to a cathode ray display tube which receives the video signal. The raster formed on the screen of the display tube occupies a part of this screen, the part being so selected by biasing deflection potentials that the displayed character will be imaged onto a light-sensitive surface at the required text position.





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PHOTOGRAPHIC TYPE COMPOSING

An advantage of photographic type-setting apparatus is the flexibility which it provides in enabling varying degrees of enlargement to be produced. The present invention has for its object to extend this flexibility to other aspects of photographic type setting and to permit an increase in the speed of operation of such apparatus by reducing the number of mechanically moving parts.

According to the invention, electronic selector means receive electrical signals defining a required character and project on to a camera tube an image of the corresponding character on a character matrix, a video signal being generated by the camera by an element-by-element scanning within the camera; a display means, e.g. a cathode ray tube is connected to receive the video signal as its modulating signal and is connected to deflection control circuits which receive input signals representing the position of the required character in the text to be exposed and which position the character on the screen of the tube in such a manner that its image falls in the required position on a light-sensitive surface to be exposed by the cathode ray tube. In a preferred form of apparatus, the characters are in a ring on a continuously moving matrix drum and a flash tube is arranged for exposing selected characters at a particular point in their path of movement, so that each character in turn passes the flash location; a store contains a number of locations, each allocated to a different character, and as each character is recognised in the input signal it is entered into the appropriate store location together with data representing the required position of this character on the sheet to be exposed. As each matrix character in turn reaches the flash location, the corresponding store location is interrogated and if an entry has been made, the matrix character is flashed as it passes the flash location and simultaneously deflection signals determined by the positional data in the store location are applied to the cathode ray display tube.

It will be seen that apparatus embodying the invention has the advantage that it does not require a moving carriage or mirror drum to project the displayed image on to different portions of the light-sensitive surface and the further advantage that the image formed from the selected matrix character may be as large as the sensitive area of the camera permits.

In order that the invention may be better understood, one example will now be described with reference to the accompanying drawing, which shows in the form of a block diagram one example of photocomposing apparatus embodying the invention.

The matrix characters are inscribed on a drum 1 which rotates continuously when the apparatus is in use. The drum 1 carries a number of rings of characters, the characters in different rings having different type faces. Behind each ring of characters is a fixed flash tube 2 so that any character can be flashed by any corresponding flash tube without mechanical movement other than the continuous rotation of the drum.

The light which illuminates a character on the matrix drum passes on to a system of prisms 3 so arranged that whichever flash tube is energised, the resulting light is imaged by an optical system 4 on to the single camera tube 5. The camera tube may, for example, be an image orthicon or a vidicon and an element-by-element scanning will take place within the tube to form a video signal. This signal is applied through the drive circuit 6 to a modulator electrode of a cathode ray display tube 7. The deflection coils 8 of the cathode ray tube receive scanning signals, synchronised with those of the camera tube 5, as the result of which an image of the required character is formed on the face of the tube 7. This image, however, occupies only a small portion of the face and is deflected to its required position on the face by means of biasing deflection potentials generated in response to signals representing the required position of the character on a film 9 to be exposed to the face of the tube through an optical system 10. Normally, it will only be necessary to deflect the image on the screen of the tube 7 in a direction perpendicular to the length of the film, to

displace the characters to different positions in the line of text exposed onto the film. It is, however, possible and is usually desirable when mathematical equations are to be set to deflect the image on the screen of the cathode ray tube in both the *x* and *y* directions in order to expose the elements of the equation in their required positions above or below the line.

The circuits for controlling the above apparatus will now be described. The characters to be exposed are obtained from one of three alternative inputs in this apparatus: the tape reader 20, which reads perforated tape, a line 21 receiving data from a magnetic tape reproducer and a line 22 connected to a separate computer. The required input is selected by means of a switch 23 and is applied to an accumulator 24 which transfers the character identities through a memory buffer register to a location in the magnetic core store 26. With the character identities there is transferred to the store location any other information present on the tape, such as type face, size and data relating to the required position of the character in the line. The tape may provide fully justified information or information which is only partly justified or not justified at all. If the information from the tape is not fully justified, the widths of the successive characters and interword spaces can be stored in the accumulator and the information transferred to the core store may, for example, include the number of width units of the character from the beginning of the line, based on minimum interword spacing, together with a record of the number of interword spaces. Then, if at the end of the line the computer finds it necessary to increase the number of units in each interword space, as each character is taken from the core store for exposure its line position information is increased by the product of the number of interword spaces since the beginning of the line and the number of supplementary units allocated to each interword space for justification purposes.

In the apparatus which is being described, the core store contains a particular location which always corresponds to the character A in a given ring of the matrix drum, another location which always corresponds to the character B in that ring, and so on. When the character A is received from the tape reader it is inserted into the corresponding location together with the additional data from the tape and this information remains in that store location until the character is required to be exposed.

As the line of text may contain a given character more times than that character appears in a ring of the matrix drum, the core store contains some overflow locations. As an example, the letter X may be present on the drum only once, but may be required twice in a particular line of text. In this case, the second X is put into an overflow location in the memory with all the relevant data as to positioning and size. It remains in the overflow location until the X location in the core store has been emptied by the exposure of the first X in the line, after which the second X with its relevant information is transferred to the X location.

In the apparatus which is being described, a complete line of characters is read into the core store before any part of that line is exposed. It will be appreciated, however, that the reading of the characters into the computer may take place while the preceding line of characters is being exposed.

The positions of the characters on the continuously rotating matrix drum relative to the locations of their flash tubes are ascertained by means of a pick-up 27 which scans reference marks on the upper margin of the drum 1. The corresponding reference pulses in the output of the pick-up tube 27 are applied to a drum position counter 28 and the resultant total is applied through an input-output buffer circuit 29 to the accumulator 24. The progressively increasing counts successively applied to the accumulator in this way indicate the successive characters in the matrix rings which are approaching the flash locations. Thus, supposing that a count of seven indicates that the character G is approaching its flash location, the application of this count to the accumulator and thence to the address register 30 causes an interrogating signal to be applied to the

storage location 7 in the core store 26. If an entry is found in an interrogated store location in the store 26, a corresponding flash signal is transmitted through the buffer register and accumulator to the input-output buffer circuit 29 and thence to the flash decoder which allocates the flash signal to the flash tube corresponding to the ring containing the character in question. At the same time that the flash signal is applied to the flash decoder, the character positioning information is brought out of the store location and is modified, if necessary for justification purposes, as explained above. It is then applied through the input/output buffer to the deflection circuits of the cathode ray tube to apply a deflection bias. This bias is such that the scanned area of the tube face is focussed through the optical system 10 on to the required position on the film 9.

The manner of obtaining the required deflection of the image scanning area on the tube face will now be described. Different areas 32 and 33 of the tube face are used for a positioning spot and for the character generation. The positioning spot area on the tube face is so located that light from the spot falls on the prism 34 and is directed through a lens 35 and a grating 36 to a phototube 37. As shown, the grating consists of a number of horizontal rows of equally spaced vertical lines, each horizontal row being slightly displaced with respect to the last. In this example there are eight horizontal rows and each row is displaced with respect to the last by one-eighth of the distance between adjacent vertical lines in any horizontal row. This grating is intended for only horizontal positioning of the image area on the tube face. The required position of the character in the line will be converted into a number of complete horizontal steps along the grating (each horizontal step being the distance between two vertical lines) and a remainder which may be, for example, three-eighths of a complete horizontal step. Taking the uppermost of the horizontal lines as a reference, the positioning light spot will be moved vertically to the third row down from this reference row and it will be moved along the row which it has located by the number of complete steps required. This system of successive vertical and horizontal displacements of the positioning spot permits an increase in speed in the location of the correct horizontal position. The initial adjustment in the vertical sense of the grating is controlled by the passage of the spot over horizontal lines or slits. Having reached this position the spot on the tube face is moved vertically into the character generation area of the tube face and thus defines the position in the horizontal sense within this area at which the character image is to be formed. The signal from the camera tube 5 and the raster deflection potentials are now applied to the tube 7 to cause the character image to be formed at the position thus specified. The extent of movement of the positioning spot is controlled by a feedback system operating on the "nulling" principle which includes the position counter 38. This counts the number of steps of movement of the spot across the grating and thus applies an actual spot position signal to the computer, in which it is compared with the required spot position. Deflection of the spot is continued until the difference between these positions is zero.

The film has advanced in the direction of its length by a motor 50. In this example, this is achieved in a step-by-step manner, the computer sending a signal through its input/output buffer 29 when the whole of the contents of the store for one line have been withdrawn and the corresponding characters have been exposed. The stepping signal is applied through the control circuit 51 to the drive circuit 52 and a pick-up 53, adjacent the film spool, detects the movement of the latter and sends to the control circuit 51 a signal confirming that the film movement has been effected. In this example, the film motor is moved in multiples of a standard increment, a multiple being chosen which will give an approximation to the correct line spacing. The characters on the face of the cathode ray tube are then displaced in the line spacing direction to an extent sufficient to make up the difference between the required line spacing and that obtained by means of the increments of movement of the motor. As an example, the apparatus might

be built to give a standard step of film displacement of .04". If the required line spacing is 0.1", then at the end of the first line the film is given two increments, making .08", and a shift in the line spacing direction is applied to the deflection potentials of the cathode ray tube of a size such as to result in a .02" displacement on the film. This makes up the deficit in the incremental movement. At the end of the next line the film is given three steps of movement, making 0.12" in all, and the line displacement of the scanning area on the tube is removed, thereby effectively deducting .02" from the film movement.

The control panel 55 is used when the input does not contain all the required information for justification, type face etc. or when it is desired to override the instructions derived from the tape. As an example, if a tape previously perforated for a particular kind of type face and point size had to be used again for a printing of the same material in a different type face and point size, the appropriate overriding instructions could be set into the apparatus by means of the control panel 55.

A program counter 56 brings into operation the various parts of the program in the required sequence. At the end of each specific operation in the computer, the total in the program counter 56 is increased by one and the new total is sent to store by way of the address register to bring out the next operation in the program which is in use. Each operation in the program is held in an instruction register 57, which instructs the computer what to do with any data (for example, that the contents of the accumulator must be transferred to the flash decoder). The program may involve changes of type face. As an example for a newspaper setting, it might be required to print the first paragraph in heavy type of a particular size, the second paragraph in a less heavy type of a smaller size, and the remaining paragraphs in type of a yet smaller size. The program counter 56 would bring these parts of the program into operation at the appropriate times.

It will be appreciated that the nature of the program carried out by the computer block will depend very much on the amount of information on the tape from which the instructions are derived. As an example, if the tape has no justification information at all, the program of the computer would have to be supplemented in a known manner with justifying circuits adding the widths of the individual characters and interword spaces and stopping the line at some natural break once the justification range is reached.

The function of the buffer circuit 29 is primarily to maintain synchronism between the computer and the photocomposing apparatus. It acts as a temporary store to hold information until the photocomposing apparatus is ready to use it.

It will be appreciated that as a character on the screen of the display cathode ray tube can be positioned anywhere across the width of the latter, it is no longer necessary to expose characters in the sequence in which they appear in the line of text. The order of exposure will, in fact, depend on the sequence of the characters on the matrix drum, thereby substantially decreasing the time required to expose a line of text.

A further advantage of using a display cathode ray tube is that a normal character can be electrically distorted to obtain a modified character, such as an italic. It may also be shifted above or below the common base line by electrical means, so that display and mathematical settings can be done easily and without loss of speed, as can the mixing of any size and style within one line of text. Enlargement or reduction of the character is obtained by simple modification of the scanning signals of the display tube in the x and y directions.

If desired, the characters on the drum may be accompanied by horizontal and vertical reference marks to develop electrical signals for use in the positioning logic circuits associated with the display cathode ray tube.

For additional speed, each type face ring on the matrix may contain duplicates or triplicates of the most commonly used characters. In a ring of 180 characters, for example, the letter e may be present 12 times. If desired, the motor may be driven continuously so that the film is fed continuously in the

direction of its length, a corresponding displacement of the character to be exposed being achieved at the cathode ray tube by applying a compensating deflection potential. Thus, as the film moves upwards, the successively generated characters for a single line are given a compensating movement over the face of the cathode ray tube, in a direction perpendicular to the direction of the line. This eliminates step-by-step movements to change from one line to the next.

Instead of employing a single cathode ray tube as a display means for the exposure of a character on to the film, two such tubes may be employed with reducing lenses such that they each supply one half of each line. This increases the available definition of the system. Alternatively, a single cathode ray tube may have two linear exposure zones across its face, and lenses can be arranged to provide both horizontal and vertical displacement to produce two end-to-end lines across the width of the film. This process of sub-division of the line can be carried further if desired.

I claim:

1. Photocomposing apparatus comprising:
a matrix of characters;

an electronic camera tube comprising a storage screen for receiving an image of a matrix character and means for thereafter scanning said storage screen, element by element, to derive a video signal representing said character; selector means for presenting any character on said matrix to a common area of said storage screen, said selector means being connected to receive input signals representing a required character and arranged to form an image of the required matrix character on said storage screen;

means for supporting a light-sensitive surface to be exposed; and electronic display means connected to receive from said camera tube a video signal corresponding to said character when said camera tube storage screen is scanned, said display means having a display screen for forming an image of said character; and

deflection control circuits connected to receive input signals representing the required position of the selected character in the text and arranged to apply to said electronic display means deflection signals to displace said character formed on said display screen to a position such that the image of this character will fall in the required position on said light-sensitive surface.

2. Photocomposing apparatus in accordance with claim 1, including means for maintaining the matrix in continuous movement during operation of the apparatus and a flash tube arranged adjacent the path of the matrix characters, and further including a store containing a different location for each matrix character, means responsive to character-representing input signals to apply a signal to the location corresponding to an input character, together with further signals representing the required position of that character on the light-sensitive surface to be exposed, location-interrogating means responsive to the approach of each matrix character in turn to the flash tube to interrogate the corresponding character locations, and means responsive to the existence of

an entry in that location to flash the flash tube and thereby expose the corresponding matrix character and to apply to the cathode ray display tube deflection potentials dependent on the position-representing signals in the said location.

3. Apparatus in accordance with claim 1, including means for subjecting the light-sensitive surface to an integral number of steps of movement at the end of each line, and means for applying to the deflection control circuits of the electronic display means deflection potentials such as to compensate for any difference between the total film movement at the end of a line and the required line spacing.

4. Apparatus in accordance with claim 1, including means for maintaining the light-sensitive surface in continuous movement in the direction of line spacing, and means for applying to the deflection control circuits of the electronic display means progressively changing deflection potentials which result in a compensating deflection of the character image on the screen of the tube.

5. Apparatus in accordance with claim 1, in which the matrix is in the form of a drum having a number of different rings of characters, each ring having a separate flash tube, the apparatus further comprising optical means for directing light rays from any flash tube on to a single camera tube.

6. Apparatus in accordance with claim 1, in which for positioning the light spot on the screen of the electronic display means in accordance with the required character image deflection, the apparatus includes optical means for guiding to a photo-electric device light from a light spot on the said screen and a grating in the light path of the said optical means, whereby movement of the light spot on the said screen causes movement of the light rays over the grating, resulting in a pulsed electric signal from the photo-electric device, the number of pulses indicating the amount of deflection of a spot.

7. Apparatus in accordance with claim 6, in which the electronic display means has two display areas on its screen, one for character-image generation and the other serving for deflection control, the apparatus including means responsive to the positioning of the light spot in a required position in the deflection control area to deflect the said spot to a corresponding position in the image generating area.

8. Apparatus in accordance with claim 6, in which the grating includes, for positioning the spot in one direction, a number of parallel rows of equally spaced lines, the lines being perpendicular to the direction of the rows, the lines in successive rows being progressively displaced by a fraction of the spacing between lines, the apparatus further including means for displacing the light spot on the display screen so that a corresponding spot moves over the grating in a direction perpendicular to the rows, and means responsive to the light rays reaching a particular row on the grating to cause deflection of the light spot on the display screen so that the light rays move along the selected row of the grating to traverse a predetermined number of lines, whereby the total movement of the spot in this direction is determined by the number of lines traversed and the selection of the row.

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