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2,698,562

METHOD FOR PHOTOCOMPOSITION OF CONTINUOUS LINEAR TYPE MATTER

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Fig. 1.

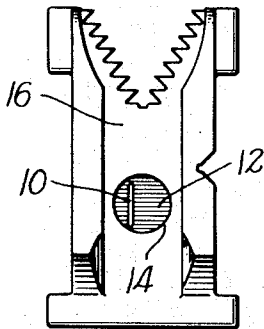


Fig. 2.

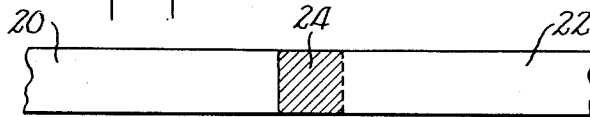


Fig. 3.

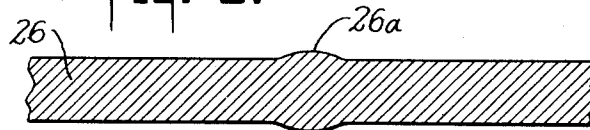


Fig. 4.

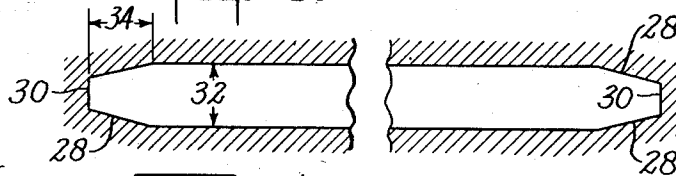


Fig. 5.

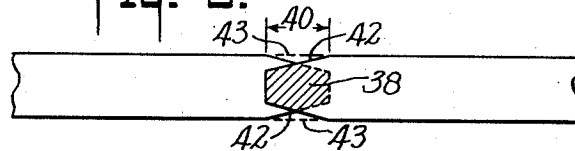


Fig. 6.



Fig. 8.

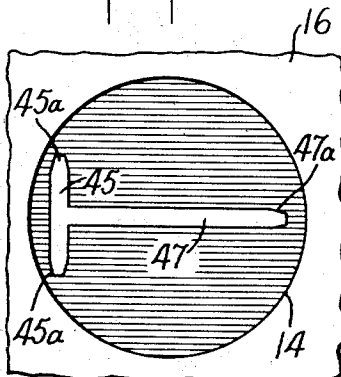
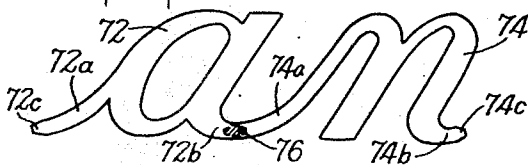


Fig. 7.

Quan.	Description	Price	Amount
62	70	66	68
52		58	60

Fig. 9.



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1

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METHOD FOR PHOTOCOMPOSITION OF CONTINUOUS LINEAR TYPE MATTER

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2 Claims. (Cl. 95—85)

This invention relates to photocomposing, and more particularly to the photocomposition of continuous linear matter such as "ruled" lines and script or other cursive type matter.

The invention is shown as applied to a system of photocomposition such as that disclosed in U. S. Patent No. 2,391,021 to E. G. Klingberg et al., wherein photographable type characters are individually borne upon matrices which are successively presented to an optical axis for projection of images of the characters onto a photographic film; between such successive exposures, the film is incrementally advanced in a line-reading direction relative to the optical axis by distances proportional to the setwise widths of the characters, thereby to space the adjacent character images properly on the film and form composed lines of type matter. The invention is equally applicable to any other system of photocomposition wherein the successive characters are individually exposed to the film, for example systems such as that disclosed in U. S. Patent No. 636,062 to F. H. Richards, wherein a plurality of photographable type characters are borne upon a drum which is rotated to align the characters successively with the optical axis.

In all of such systems, continuous linear matter may be composed by successive exposure to the film of a plurality of photographable characters each comprising a setwise segment of the linear matter, and advancing the film between successive exposures by distances equal to the setwise widths of such segments so that their images on the film will be adjoined to present the appearance of continuity. In the case of straight "ruled" lines, the segments are in the form of dashes; in the case of script, the photographable script characters borne by the respective matrices are each provided with leading and trailing ligatures which may be adjoined with the ligatures of the adjacent letters of a composed word to achieve cursive-ness or continuity between letters, as in a handwritten word.

It is obviously difficult, by ordinary mechanical means, to advance the film between successive exposures by distances exactly equal to the setwise width of the character images. If the film advance slightly exceeds the setwise widths of the character images, gaps will be left between adjacent images, so that the ultimately printed linear matter will be discontinuous. On the other hand, if the film advance is deficient, the ends of the adjacent images will overlap, doubly exposing the film and producing distorted images, as will be described more particularly hereinafter. An excess or deficiency of only a few thousandths of an inch in the extent of film advance may result in unacceptable printed work. These difficulties in the photocomposition of ruled lines and script or other cursive type matter have heretofore constituted a substantial restriction on the utility of photocomposing machines.

The present invention provides for the first time practical and effective means for overcoming these difficulties. The invention comprises a photographable segmental type character the ends of the connective portions or ligatures of which are tapered; in the practice of the invention, the incremental advance of the film is intentionally made slightly less than the overall setwise width of the character image so that the tapered end portions of the adjacent images are caused to overlap. The extent of such intentional overlap may exceed the tolerance in the advance of the film so that the possibility of discontinuity of the composed linear matter is substantially eliminated. Also, the

2

tapered end portions avoid the objectionable effects of double exposure in the region of the overlap, in the manner to be described hereinafter.

In the drawings:

5 Figure 1 is a broad side view, at slightly enlarged scale, of a character bearing element or matrix of the class to which the present invention may be applied;

10 Figure 2 is a diagrammatic view at greatly enlarged scale of a portion of a photographic record illustrating the photocomposition of a ruled line in accordance with prior practice, wherein the ends of adjacent line segments overlap;

15 Figure 3 is a view of a corresponding portion of the ultimate printed line produced by use of the photographic record made as shown in Figure 2 and illustrating the effect of double exposure of the film in the region of the overlap;

Figure 4 shows a photographable type character embodying features of the present invention;

20 Figure 5 is a view similar to Figure 2, but diagrammatically illustrating a photographic record made in accordance with the present invention;

Figure 6 is a view similar to Figure 3, but showing a portion of a printed line produced by use of the record made as shown in Figure 5;

25 Figure 7 shows a ruled business form of the type which may be composed photographically in accordance with the present invention;

Figure 8 is a broad-side view of a portion of a character-bearing element or matrix including a photographable character embodying features of the present invention and being especially adapted for the composition of printed matter having both horizontal and vertical ruled lines; and,

30 Figure 9 illustrates cursive script type matter printed from a photographic record produced in accordance with the present invention.

In Figure 1 is shown a matrix of the general class disclosed in my U. S. Patent No. 2,231,899, wherein the photographable type character, in this case a line segment or dash 10, is borne upon a plaque 12 in a circular opening 14 which extends through the central body 16 of the matrix. The plaque 12 is usually opaque and the type character 10 is usually in the form of transparent area in the opaque field of the plaque. Such matrices are usually employed in a photocomposing machine wherein the several matrices corresponding to the characters of a line of type are selected from a type magazine by actuation of appropriate keys on a keyboard. The matrices are assembled in a face-to-face abutting line with the matrix at the left-hand or starting end of the line against an end wall of the machine and with the line of matrices urged leftward by means of a spring-biased follower arm. The matrices are individually and successively removed from the left-hand end of the line and carried upwardly to bring their plaques 12 into alignment with the optical axis of the machine. A light source and a system of lenses on the optical axis are employed to project onto a photographic film the images of the successive characters. The film is mounted in a movable holder which is mechanically connected to the line follower so that as each matrix is removed from the end of the line of matrices and the line follower causes the remaining matrices to move leftward to occupy the space thus vacated, the film is advanced in a line-reading direction. The thicknesses of the matrices are proportioned to the setwise widths of the characters respectively borne thereby so that the extent of advance of the film is sufficient to provide a fresh film field for each successfully photographed character. Since the movement of the film is downward, the photographable characters are recumbent on the matrices—that is, are rotated through 90° from their normal upright position so that their projected images will be properly oriented with respect to the film.

75 Since the advance of the film usually is effected through a train of mechanical linkages in which there may be some "play" or slippage, it is difficult to control the extent of the advance of the film to a greater accuracy than the order of a thousandth of an inch. In the composition of ordinary text, the resulting minute variations in letter spacing are imperceptible and, for all practical purposes,

negligible. However, in the composition of ruled lines or other continuous linear matter, such variations may become material. If the extent of the increments of advance of the film slightly exceeds the setwise width of the line segments, gaps will be left between the images of adjacent line segments and the ultimately printed line will exhibit discontinuity. If, on the other hand, the film advance is slightly deficient, the ends of the images of adjacent line segments 20 and 22 will overlap, as shown at 24 in Figure 2.

As is well known in the photographic art, double exposure or over-exposure of photographic film results in halation, i. e. spreading of the area in which the emulsion of the film has been chemically reacted, an effect probably produced either by reflection or scattering of light from the brightly illuminated portions of the image to adjacent portions of the film which are less brightly illuminated, or a spreading of the actinically initiated chemical reaction from the particles or grains of the film which were exposed to light to adjacent grains which were not exposed. The halation effect is especially noticeable at sharp boundaries between extremely bright portions of the image and adjacent extremely dark portions; since there are usually no intermediate gradations of illumination in the images of the type characters in photocomposition, but only areas which are either fully illuminated or completely darkened, photocomposition is especially vulnerable to the effects of halation.

The extent of the spreading is of course proportional to the degree of exposure of the film. The double exposure of the photographic film in the region of the overlap 20 (Figure 2) will thus produce marked local halation. When the film is developed and the printing plate produced therefrom is used for printing, the resulting printed line, as shown in Figure 3, will have protuberances 26a in each of the areas corresponding to the double exposed areas 20.

Figure 4 illustrates a photographable type character embodying features of the present invention, by which the aforementioned defects may be substantially eliminated. The particular photographable character illustrated is a line segment or dash such as that used in the composition of ruled lines. Each end of the line segment is formed with a tapered portion 28 tapering in thickness toward the end 30 of the line segment. In a 12-point dash, for example, the thickness 32 of the dash may be of the order of .007"; with a dash of such dimensions, the length 34 of the tapered portion 28 may suitably be .004" and the degree of tapering may be such that the end dimension 30 of the dash is .005"—that is, each side of the dash may be tapered .001". The ratio between the overall length of the dash and the thickness of the matrix on which it is borne, as well as the driving ratio between the follower arm and the film holder are such that the film is advanced between successive exposures by distances slightly less than the overall length of the dashes. Thus, as shown in Figure 5, the ends of the adjacent dashes are intentionally caused to overlap by a distance 40 approximately equal to the length 34 of the tapered portion 28 at the end of each dash. As shown in Figure 5, this will result in a slight indentation 42 at each side of the juncture between images of adjacent dashes. However, since the film in the area 38 between these indentations 42 has been doubly exposed, the resulting spreading of the reaction of the film emulsion will substantially fill out the indentations 42, as indicated by the broken lines 43 in Figure 5, to produce a photographic record in the form of a straight line of substantially uniform thickness. The ultimately printed line, as shown in Figure 6, will exhibit no perceptible break or variation in thickness.

Satisfactory results may be obtained although the extent of film advance varies so that the two ends overlap less than the intended extent to a lower limit wherein there they barely overlap at all, or so that the overlap exceeds the intended extent to an upper limit wherein the overlap is twice the length of the tapered end portions. This allows in the extent of film advance a tolerance readily attainable in modern commercial photocomposing machines.

In Figure 7 is shown a typical business form embodying both horizontal and vertical ruled lines and interlinear printed material. Figure 8 illustrates the plaque of a matrix used in composing a form such as that shown in Figure 7 in accordance with the present invention. The photographable character on the plaque includes adjoined perpendicular portions 45 and 47 for producing horizon-

tal and vertical line segments respectively; all of the ends 45a and 47a of the character are tapered as above described.

In producing a form such as that of Figure 7, first the matrices for producing the top horizontal line 48 are assembled in order from left to right. The left-hand portion 46 of the top horizontal line 48 is produced by a plurality of matrices such as that shown in Figure 1, each bearing a photographable line segment 10 which is vertically oriented for the production of a horizontal image on the film. A matrix of the type illustrated in Figure 8, is employed to produce on the film the portion of the form indicated at 50 in Figure 7 and including a portion of the top horizontal line 48 and the top portion of the left-hand vertical line 52. The remainder of the top line 48 is produced by a group of dash matrices such as that shown in Figure 1, including, at the proper intervals within the group for production of the areas 54 and 56, matrices such as that shown in Figure 8. After this first line of matrices is assembled, the matrices are individually photographed in order, the film being advanced between successive exposures so that the adjacent tapered ends of the dashes slightly overlap, as above described. The film is then returned to the left-hand or starting margin 44 of the line, without advancing the film columnwise; next, the printed column heads 62, 64, 66 and 68 are composed by assembling the matrices bearing their respective letters with proper spacing matrices between the several words, and successively photographing the letters in the usual manner. The position of the photographable dash elements 10 on their respective matrices is such that although the film was not advanced after production of the top line 48 and before production of the column heads 62, 64, 66 and 68, in the produced copy the top line 48 is properly positioned above the column heads. After production of the column heads, the film is again returned to the starting margin 44, this time, however, allowing the film to be advanced columnwise as in routine photocomposition. The second horizontal line 70 and the adjacent portions of the vertical lines 52, 58 and 60 are then composed in a manner identical to that in which the upper horizontal line 48 was composed, and so with the succeeding horizontal lines and their respective portions of the vertical lines until the entire form has been composed. At each junction between the line segments, the ends of the adjacent line segments are tapered and the extent of film advance is such that the tapered ends of adjacent images are intentionally overlapped to achieve in the ultimately printed copy straight lines of uniform thickness.

Figure 9 illustrates the application of the invention to the composition of cursive script. As is shown, each of the script characters 72 and 74 is provided with connective portions or ligatures 72a and 72b and 74a and 74b respectively, the end portions of each of which are tapered as at 72c and 74c; in photographing the end portions of the ligatures of adjacent character images are intentionally caused to overlap as at 76 with the desirable results described hereinabove.

It will thus be seen that the present invention makes possible the production of linear matter such as ruled lines or cursive script and the like, wherein the adjacent segments of the linear matter are smoothly adjoined or blended without the defects which have characterized such printed matter heretofore produced by photocomposition. It should be emphasized, however, that the particular embodiments described and shown herein are intended as merely illustrative and not as restrictive of the invention.

I claim:

1. The method of photocomposition of continuous linear matter such as ruled lines and cursive script which comprises successively exposing a photosensitive film along an optical axis in a plurality of areas each corresponding to a setwise segment of the linear matter and having end portions which are tapered in thickness, and advancing the film relative to said optical axis between such successive exposures by distances slightly less than the setwise widths of such areas so that the ends of the adjacent areas are caused to overlap by distances in the range between the approximate length of said tapered end portions and slightly less than two times said length.

2. The method of photocomposition of continuous linear matter such as ruled lines and cursive script which comprises successively exposing a photosensitive film along an optical axis in a plurality of areas each corresponding to a setwise segment of the linear matter and

5

having end portions which are tapered in thickness, and advancing the film relative to said optical axis between such successive exposures by distances slightly less than the setwise widths of such areas so that the ends of the adjacent areas are caused to overlap by distances of the same order as the length of said tapered end portions thereby leaving indentations at the junction of the outlines of said character images and doubly exposing said film in the overlapping portions of said character images

6

to produce halation of said film which tends to fill out said indentations to cause the outlines of said character images to blend more smoothly one into the other at said junction.

References Cited in the file of this patent**UNITED STATES PATENTS**

2,165,861 Krauter ----- July 11, 1939