

Feb. 18, 1941.

R. H. TURNER ET AL

2,231,972

METHOD OF AND APPARATUS FOR PHOTOGRAPHIC COMPOSITION

Filed March 23, 1938

2 Sheets-Sheet 1

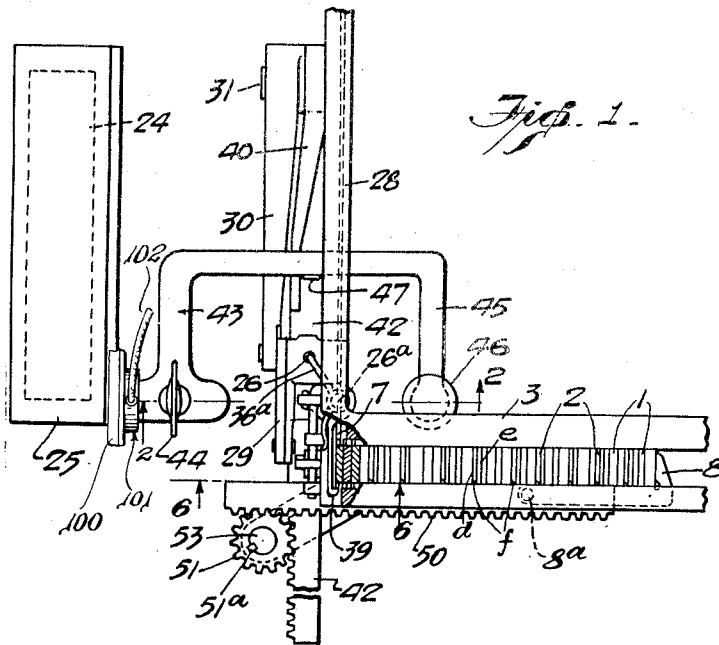


Fig. 1.

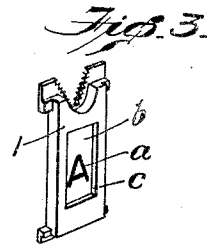


Fig. 3.

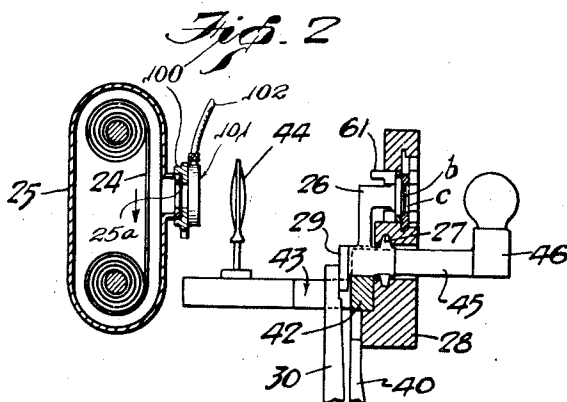


Fig. 2.

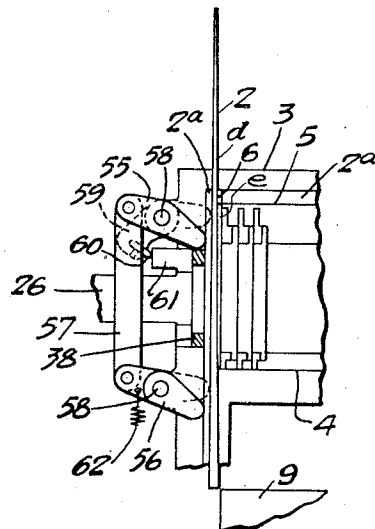


Fig. 6.

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2 Sheets-Sheet 2

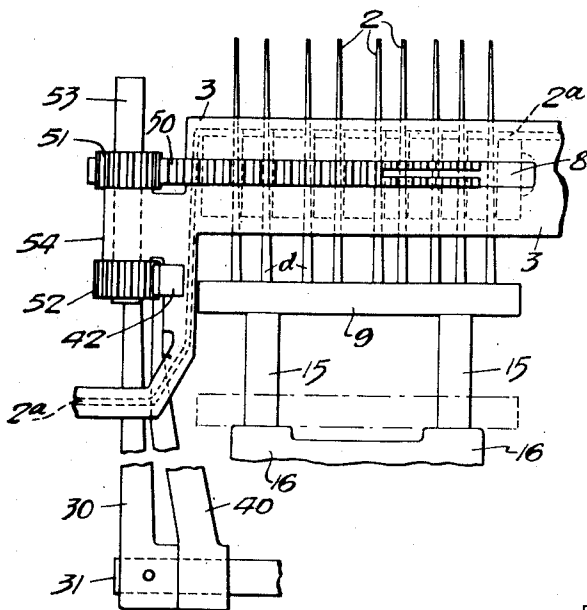


Fig. 4.

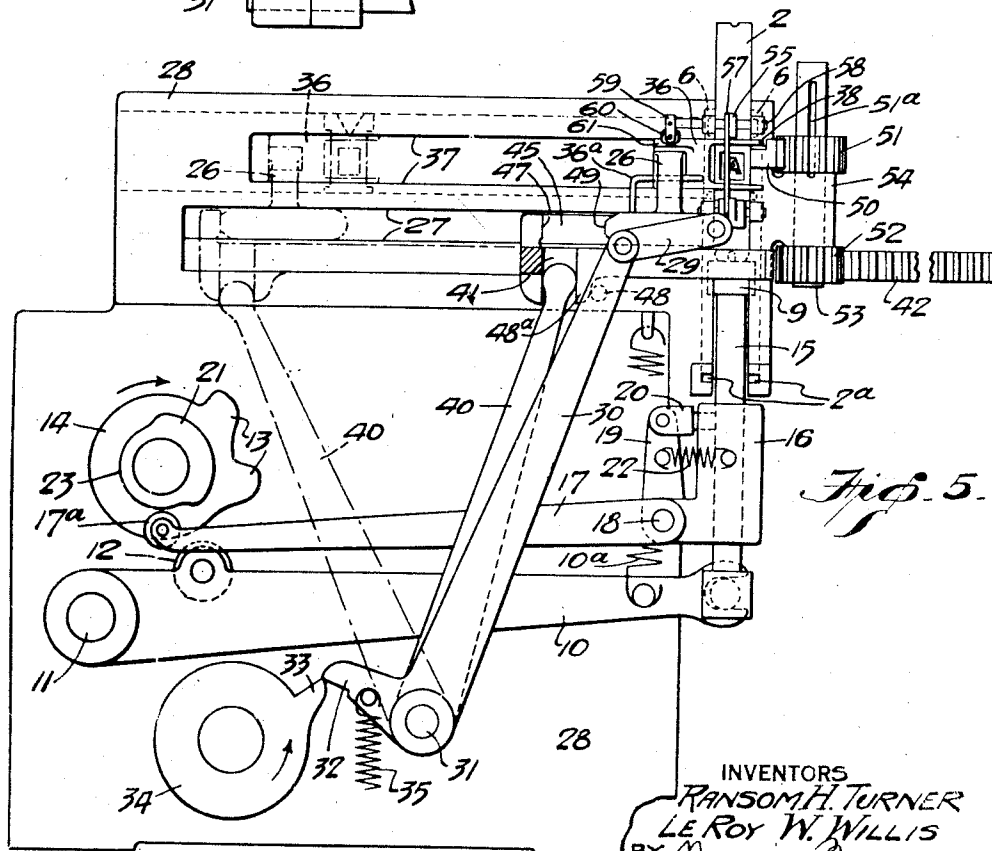


Fig. 5.

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METHOD OF AND APPARATUS FOR PHOTOGRAPHIC COMPOSITION

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In Switzerland May 24, 1937

22 Claims. (Cl. 95-4.5)

The present invention relates to a method of and apparatus for photographically producing type matter for printing processes, which method and apparatus may be conveniently adapted to matrix line composing and slug casting machines of the usual and well known kinds by replacing the casting devices of such machines with apparatus for the photographic exposure, on a plate, film or other sensitized surface, of the matrices of the general form commonly used in such machines but having their characters on the flat or broad side thereof.

It has been attempted to accomplish this result by photographing whole lines of matrices as a unit or entirety. Such a method however is impractical because of numerous inherent defects among which may be mentioned the necessity of using a wide angle lens with resulting aberration and distortion of the reproduced characters in different portions of the line, and the lack of sufficient illumination and contrast of the character images and consequent failure to reproduce the lines of the characters with the high degree of definition required for good typography, due to the location of the characters to be reproduced on the edges of the matrices in the line, whether reflecting or transparent type characters are employed.

In order to overcome such defects, a method has already been proposed in which the matrices are removed singly and successively from composed matrix lines, justified by spacers to a desired line length and then photographically exposed individually at a common point, thus enabling the characters to be reproduced without distortion and with the requisite degree of definition, the slack left in the composed line after removal of each matrix for exposure of its character being taken up by pushing together the matrices remaining in the line, and such closing-up motion being transmitted in accordance with each character and space to the sensitized surface which is thereby advanced into position for each succeeding photographic exposure.

According to the present invention, these advantages of character reproduction without distortion and with the requisite degree of definition are achieved, but the film or other sensitized surface does not advance for each new exposure but, instead, the sensitized surface remains stationary during the photographing of each line, each matrix in the line being presented for exposure at a new photographing position determined in each instance by the justified position

of the matrix, and correspondingly of its character, in the composed line.

Preferably, each matrix is removed or displaced from the line and moved relatively to the sensitized surface to bring it into photographing position, and for thus moving the matrices relatively to the sensitized surface, the motion due to the closing up of the line after removal of each matrix and justifying spacer, is transmitted step by step to a stop device connected to the line closing device, such stop carrying the lens and light source with it to each new photographing position along the aperture of the camera. During the step by step advance of the stop device, the line is retained in justified condition so that successive exposure positions determined by the stop device correspond exactly to the justified location of the respective matrices and thus to their characters in the composed line.

By thus connecting together the line closing device and the stop device for coordinated action in controlling movement of the matrices to progressively located exposure positions, such inaccuracies as might arise from wear and lost motion in the more complicated mechanism involved in extending connections from the matrix line for moving the remotely located film or sensitized surface are avoided, the moving of the matrices relatively to a stationary film or sensitized surface assuring such perfect accuracy in the location of the characters and of the spaces between them or the words they form that the length of the finally reproduced line, comprising the justified character and space increments added together, cannot fail to correspond exactly to the justified length defined by the composed line.

To more specifically point out the advantages of the structure herein disclosed, it may be explained that the sensitized surface is stationary and the only movement necessary to produce each of the successive exposures thereon is that of the matrix itself, each successive matrix being moved under positive control to a new photographing position. In the structure previously proposed, according to which the matrices are photographically exposed individually at a common point, two movements are necessary for each exposure, namely, movement of the matrix into photographing position and also movement of the sensitized surface. The problem of coordinating these two movements and obtaining the required accuracy of relative locations of matrix and film is avoided by the present invention.

In the accompanying drawings, which illustrate the preferred embodiment of an apparatus for use in carrying out the invention:

Figure 1 is a top plan view, partly in section, of a photographic apparatus, showing a composed line of matrices and spacers and the connected line closing and stop devices associated therewith for controlling progressive movements of the matrices;

Figure 2 is a vertical section, taken on the line 2-2 in Fig. 1;

Figure 3 is a perspective view of a matrix modified for photographic purposes in carrying out the present invention;

Figure 4 is a front elevation of a portion of the apparatus as viewed from the front in Fig. 1 and from the right in Fig. 5;

Figure 5 is a side elevation, on an enlarged scale, of the apparatus shown in Fig. 1 as viewed from the left in that figure, the camera and lens being omitted; and

Figure 6 is a detail vertical section, on an enlarged scale, taken on the line 6-6 in Fig. 1.

Similar parts are designated by the same reference characters in the different figures.

The line of matrices 1 and spacers 2, which may be composed in any well known form of line composing machine through manipulation of the keyboard in well known manner, is delivered in any suitable way to a channel-like holder 3, as shown in Fig. 1, this holder having a lower rail 4 on which the matrices rest and an upper rail 5 on which the spacers hang by their ears 6. The matrices conform in general with those commonly used in line composing machines except that their characters *a* are carried on a transparent film *b* suitably secured in an opening *c* which extends through the matrix from one flat side to the other flat side thereof to permit transmission of light through the film when the flat side of the matrix is presented for photographic exposure. The spacers 2 are of the general form used in line composing machines comprising two wedge-like members *d* and *e*, the wedge member *d* being longer than the member *e* and slidable relatively thereto for the purpose of expanding the line of matrices and thus justify them to a desired line length in well known manner, but for the purposes of the present invention, a side edge of the spacer member *d* is bevelled at *f*, for reasons hereinafter explained.

The composed line of matrices and spacers is justified in the channel 3 between a fixed end wall 7 thereof and a follower 8 which is movable longitudinally of the channel 3 but normally located at a position along the channel corresponding to the desired line length. The matrix line in the channel 3 is justified by the action of a bar 9 which, at the proper time, is caused to rise and drive the long wedge members *d* of the spacers upwardly, as shown in Figs. 4 and 5. Such driving action is produced by the upward swing of a lever 10 under the action of a justification spring 10^a, this lever being pivoted to the machine frame at 11 and carrying a roller 12 arranged to be acted upon by lobes 13 on a cam 14, the latter being suitably rotated in the direction indicated by the arrow. The free end of the lever 10 is pivotally and loosely connected to vertical rods 15 which carry the bar 9, these rods being guided in fixed bearings 16. The bar 9 is retained at the highest position it reaches in justifying the line, for reasons hereinafter explained, by means of a suitable locking device such as a

lever 17 mounted on a fixed pivot 18 supported on the machine frame, the lever 17 having an arm 19 which extends upwardly therefrom and carries a friction clamp 20 slidable in one of the bearings 16 and engageable with one of the rods 15. During the justifying action of the lever 10, the clamp 20 is held out of engagement with the rod 15 by the action of a cam 21 acting on a roller 17^a on the free end of the lever 17, against the action of a spring 22, and upon completion of the upward drive of the bar 9, the low portion 23 of the cam 21 frees the lever 17 and thus allows the spring 22 to press the clamp 20 against the rod 15, thereby holding the bar 9 in the highest position it reaches in justifying the line. The roller 12 on the lever 10 rests normally on one of the lobes 13 of the cam 14, so that the justification spring 10^a is stretched, and upon rotation of the cam 14, the spring 10^a swings the lever 10 upwardly to effect the justifying action of the bar 9 on the spacebands in the line in the channel 3.

The film or other sensitized surface for receiving the photographic impressions of the characters as the individual matrices are photographically exposed is contained in a casing 25 which may be suitably secured in a stationary position on the machine frame, and the sensitized surface may be in the form of a film 24 mounted on rollers as indicated in Fig. 2 and arranged to move the film in the direction indicated by the arrow in that figure to present a new area thereof for each succeeding line. Apart from the line for line advance of the film, the film and its casing remain stationary, it being a feature of the present invention that the characters in a given line will be exposed to the film, one in succession of the other, until the entire composed line is photographically reproduced, and in order to permit such successive exposures of the individual characters, the camera casing 25 is provided with an elongated aperture 25^a which may be fitted with a suitable shutter device arranged to open at the successive points of exposure of the characters as they are presented for photographing. The particular form of the shutter and devices for operating it form no part of the present invention and any suitable and known form of shutter and operating devices may be used. Thus, as shown in Figures 1 and 2, the shutter mechanism may comprise a member 100 carrying a shutter generally indicated at 101 of the usual type and operable by means of a Bowden wire generally indicated at 102, which Bowden wire may be operated in synchronism with the matrix positioning mechanism. Means is provided for presenting each following matrix removed from the composed line at its proper photographing position in relation to the stationary film, such means as shown in the present instance comprising a carriage 26 which is mounted to move in a guideway 27 formed in the machine frame 28. This carriage is connected by a loosely pivoted link 29 to a lever 30, the latter being pivoted on a shaft 31 and having an arm 32 for actuating it under the influence of a lobe 33 on a rotary cam 34 against the tension of a spring 35. A pawl or carrier 36 is pivoted on the carriage 26 on a pin 26^a on the carriage, this pawl being movable with the carriage in a channel 37 in the frame 28. The pawl 36 is forked at one end, as shown in Fig. 5, to provide a pair of fingers 38 having hooks 39 at their ends. The pawl 36 is acted on by a spring 36^a, in the manner hereinafter described. A lever 40 is also mounted to swing on the shaft 31, this

lever freely engaging at its upper end in a slot 41 in a toothed rack 42, said rack having an arm or carrier generally indicated at 43 secured thereto and supporting the lens 44 and an arm 45 supporting a light source 46, said lens and light source comprising the optical system of the camera, and the rack 42 also carries a stop 47 which is engageable with a face 49 on the movable carriage 26. Lever 40 may be manually operated to return rack 42 and the optical system carried thereby to normal or starting position after completion of each line.

A toothed rack 50 is suitably guided to slide in the front wall of the channel 3, the follower 8 being pivotally connected to this rack, as at 8^a. The rack 50 is geared to the rack 42 by means of pinions 51 and 52 mounted on a shaft 53 journaled in a bearing bracket 54. The pinion 52 is preferably keyed or otherwise fixed to the shaft 53, but the pinion 51 is preferably splined on the shaft 53, as by means of a sliding key and keyway 51^a so that this pinion may be lifted out of engagement with the rack 50 and the latter adjusted to vary the position of the matrix line follower 8 to conform with matrix lines of different lengths and then re-engaged with the rack bar 50, independently of the rack bar 42. While the follower 8 is connected to the stop 47, through the racks and pinions described, it is sustained against spreading beyond the line measure position during justification of the line by a pin 48 which is fixed to a stationary part of the machine frame in the path of a projection 48^a on the rack 42 so that it will hold the follower 8 at the desired line measure position against the expansion of the matrix line during justification.

According to the present invention, after the matrix line has been placed in the channel 3 and justified to a desired length between the wall 7 and follower 8, the matrices are moved relatively to the film or sensitized surface in such a manner that each following matrix is presented for exposure at a new photographing position and the succeeding photographing positions in each instance correspond to the justified position of the matrix and correspondingly of its character in the composed line. Preferably and as shown in the present instance, such relative movement of the matrices with respect to the stationary film is accomplished by displacing each succeeding matrix from the line and moving it the necessary greater distance corresponding to its particular photographing position in front of the film. This is accomplished, in using an apparatus such as that herein shown and described, as follows: The matrix line is placed in the channel 3 and justified between the wall 7 and follower 8 by expanding the spacebands in the line by the upward stroke of the bar 9. Since the line is justified against the follower 8, the follower, through the racks and pinions connecting it to the stop 47, retains the latter at a position to the right in Fig. 5 corresponding to the zero or marginal position denoting the beginning of the line to be reproduced on the film, it being noted that the follower 8 is held against movement to the right in Fig. 1 during justification by the pin 48 in the path of the projection 48^a on the rack 42 which carries the stop 47. When the stop 47 is in this position, the stop 49 on the carriage 26 will be engaged therewith under the influence of the lever 30 acted on by the spring 35. In Fig. 5, however, the parts of the machine are shown in the positions which they oc-

cupy after the machine has started to operate, and rotation of the cam 34 in the direction indicated by the arrow has actuated the lever 30 and moved the carriage 26 to the right for engagement of the hooks 39 on the fingers 38 with the edge of the leading or foremost matrix in the line, the pawl 36 carrying these hooks being swung on its pivot 26^a against the action of the spring 35^a sufficiently to permit the fingers 38 to ride over the flat face of the leading matrix and the spring 36^a causing the hooks 39 to swing into positions to engage the edge of the leading matrix as shown in Fig. 1 when the carriage 26 has completed its stroke to the right in Fig. 5. Continued rotation of the cam 34 causes its lobe 33 to pass out of engagement with the arm 32 of the lever 30 whereupon the spring 35 will immediately cause the carriage 26 to move to the left in Fig. 5 and to carry with it the leading matrix engaged by the hooks 39 of the fingers 38, thereby removing or displacing such matrix from the line.

Such removal of the leading matrix will obviously leave an amount of slack in the composed line standing in the channel 3 corresponding to the thickness of the removed matrix, and the thicknesses of the matrices will vary according to the widths of the characters which they bear. As the carriage 26 moves to the left in Fig. 5, the stop 49 thereon comes into engagement with the stop 47 on the rack 2, and immediately upon such engagement and because of the action of the spring 35 on the carriage, the rack 42 will be pulled to the left as viewed in Fig. 5. Such movement of this rack will rotate the pinions 51 and 52 and thereby move the rack 50 to the left, as viewed in Fig. 1, and such movement of the rack 50 will advance the follower 8 and with it, of course, the entire line of matrices and spacers remaining in the channel 3, so that the next succeeding element in the composed line in the channel 3, whether a matrix or spacer, will stand against the fixed wall 7.

The first matrix displaced from the line is thus moved into its proper photographing position with respect to the film or sensitized surface, and the instant the matrix reaches such a position, the shutter of the photographic apparatus is operated so that through the medium of light from the light source 46 and the lens 44 which focuses the character on the matrix thus positioned, said character will be reproduced photographically on the film. Immediately after the exposure of the character on the first matrix, the cam 34, which rotates at a speed just sufficient to permit such exposure, will arrive at a position where its lobe 33 will again actuate the lever 30 to move the carriage 26 to the right (Fig. 5) for engagement with the next matrix and to then release the lever 30 to permit it to operate under the influence of the spring 35. Thus, the second matrix is removed or displaced from the line, and its displacement from the leading end of the line will produce at that point a space corresponding to the thickness of the displaced matrix, and such space will be taken up immediately upon engagement of the carriage 26 against the stop 47, such engagement again pushing the line together by movement of the follower 8, through the connecting racks and pinions. The second matrix displaced from the line will thus be located further along the channel 37 than was the matrix first displaced or in other words will be located at a new photographing position, and such position will be de-

terminated by the position the second matrix occupied in the composed line when justified. This process of displacement of the matrices singly and successively from the line and movement of the matrices to successive photographing positions corresponding with the positions occupied by the respective matrices in the justified line, will be repeated until the entire composed line has been dissipated and the characters of the individual matrices as they are brought to the successive photographing positions along the channel 37 have been exposed photographically. After exposure of each matrix, it remains in the channel 37 and will be pushed together with preceding matrices further along this channel by the displacement of the next matrix from the line, and the matrices may be discharged from the channel 37 to any suitable means for disposing of them, as for example the matrix distributing devices such as are used on ordinary line composing machines.

Since the spacers used in the composed line determine the justified positions of the matrices therein and the space to be provided between the words in the line as reproduced on the film or sensitized surface, the space occupied by such spacers after justification of the line must be preserved throughout the photographic reproduction of the characters on the succeeding matrices in order that the length of the reproduced line will correspond exactly to the justified length of the composed line. To so preserve the line in justified condition, the justification bar 9 is retained by the friction clamp 20 in the uppermost or highest position it reached under the influence of the justification cam 14 as hereinbefore explained. Accordingly, as the entire line of matrices and spacers remaining in the channel 3 is moved toward the left as viewed in Fig. 4 each time an element is displaced from the leading end of the line, the lower ends of the wedge members *d* of the spacebands will slide toward the left along the bar 9, as viewed in Fig. 4. When a spaceband becomes the leading element in the line, its leading face will rest against the fixed wall 7, and at that time the lower end of the spaceband member *d* will have passed beyond the left hand end of the bar 9, as shown in Fig. 6, where it will no longer be supported by the justification bar. In order to prevent a spacer from thus dropping by gravity after the matrix immediately in front of it has been displaced from the leading end of the line, upper and lower pawls 55 and 56 are provided, these pawls being pinned or otherwise fixed to short shafts 58 pivoted in bearings on the end of the channel 3, the shafts 58 being connected pivotally for simultaneous rotation by a link 57. The upper shaft 58 has an arm 59 pinned thereon, this arm carrying a roller 60 which, when the carriage 26 occupies its right hand position as shown in Fig. 5 due to the action of the lobe 33 of the cam 34 on the arm 32 of the lever 30, rests on a rise or cam surface 61 on the upper edge of the pawl 36. Thus, each time the carriage 26 shifts to the right, as shown in Fig. 5, to engage and displace another element from the leading end of the line, the pawls 55 and 56 will be rocked to the full line positions shown in Fig. 6. However, as soon as the carriage 26 shifts to the left (Fig. 5) under the action of the spring 35, the roller 60 will be released from the rise or cam surface 61 and, under the influence of a tension spring 62, the pawls 55 and 56 will be swung into the

dotted line position shown in Fig. 6. Should the leading element in the line be a spacer, the pawls 55 and 56 will yieldingly engage the leading face of such element immediately upon the advance of such spacer element against the wall 7. Such engagement of the pawls with a spacer element will prevent the long wedge member *d* thereof from sliding downwardly and will also prevent the spacer from dropping by gravity through the downwardly turned portion of the channel 2^a until the carriage 26 again moves to its extreme right hand position shown in Fig. 5, at which time the roller 60 will again ride up on the rise or cam surface 61 on the carriage and rock the connected pawls 55 and 56 out of engagement with the spacer.

By thus retaining a leading spacer in the line after the matrix immediately preceding it is moved out of the line to its photographing position, the thickness of the spacer thus retained, or in other words the space occupied in the justified line by the expanded spacer, is measured before the spacer drops out of the line, thus providing for the advance of the matrix following such spacer to a photographing position further along the film through a distance equal or proportionate to the justified space produced by the spacer in the composed line.

It will be noted that the front edge of each spacer element is bevelled, as indicated at *f* in Fig. 1, so that when the carriage 26 moves to the right to remove the next leading element from the line and such element is a spacer about to drop into the downwardly extending portion of the channel 2^a due to release by the pawls 55 and 56, the hooks 39 of the fingers 38 will ride freely past the falling spacer when said carriage makes its next stroke to the left. By the time the carriage 26 engages the stop 47, the released spacer will have dropped in channel 2^a clear of the line, and the stop 47 will of course be advanced a distance equal to the thickness of such spacer in its justified condition, or until the matrix in the line immediately following the released spacer stands against the wall 7 under the pushing or line closing action of the follower 8.

It will be noted in Figs. 4 and 6 that the ears 6 of the spacebands are guided in the groove 2^a and that at the left hand end of the channel 3 this groove turns downwardly in order to guide the spacebands by their ears when they are finally released by the pawls 55 and 56 and drop by gravity from the left hand end of the channel, from which they may be returned to a suitable place of storage or otherwise disposed of.

We claim as our invention:

1. Apparatus for producing type matter photographically from composed lines of character bearing elements, comprising a channel having a fixed and a movable end wall for confining the respective ends of the lines therein, a support for a stationary sensitized surface disposed perpendicular to the length of said channel, means operative to displace said elements singly and successively from a line and to bring each displaced character bearing element into a different photographing position relatively to the sensitized surface corresponding with the respective positions occupied by such character bearing elements in the line prior to displacement therefrom, and means for photographing the characters on said character bearing elements onto the sensitized surface while said

elements respectively occupy such photographing positions.

2. Apparatus for producing type matter photographically from composed matrix lines, comprising a channel to confine such lines endwise therein, means for displacing the matrices singly and successively from the line into photographing positions, means for advancing the matrices remaining in the line after the displacement of each matrix therefrom, and a stop connected to move with the matrix advancing means and cooperable with said matrix displacing means to determine the photographing positions to which the matrices are displaced.

3. Apparatus for producing type matter photographically from composed lines of character bearing matrices and spacers, comprising a channel to contain such lines, means for displacing the matrices and spacers singly and successively from the line into photographing positions, means for advancing the matrices and spacers remaining in the line after the displacement of each matrix or spacer therefrom, means for releasably retaining each spacer prior to its displacement from the line, and a stop connected to the matrix advancing means and movable by the matrix displacing means to measure the thickness of a matrix prior to the release of a spacer by said spacer retaining means.

4. Apparatus for producing type matter photographically from composed matrix lines, comprising a channel adapted to confine the matrix lines endwise therein, a support for a stationary sensitized surface, a carrier movable relatively to the sensitized surface and supporting an optical system for photographically exposing the sensitized surface, means for displacing matrices singly and successively from the line into photographing positions, a follower connected to said carrier for advancing endwise along the channel the matrices remaining in the line after each matrix is displaced therefrom, and means actuated by the matrix displacing means for controlling the movement of said carrier and said follower.

5. Apparatus for producing type matter photographically from composed matrix lines, comprising a channel adapted to confine the matrix lines endwise therein, a support for a stationary sensitized surface, a carrier movable relatively to the sensitized surface and supporting an optical system for photographically exposing the sensitized surface, means for displacing matrices singly and successively from the line into photographing positions, means connected to said carrier for advancing the matrices remaining in the line after each matrix is displaced therefrom, said matrix advancing means having means for actuating it by said matrix displacing means and controlling the movement of said carrier.

6. Apparatus for producing type matter photographically from composed lines of character bearing matrices and spacers, comprising a channel adapted to confine such lines endwise therein, a support for a stationary sensitized surface, a carrier movable relatively to the sensitized surface and supporting an optical system for photographically exposing the sensitized surface, means for displacing the matrices and spacers singly and successively from the line and for moving the matrices individually into successively located photographic positions, means for retaining a spacer against displacement during the movement of a preceding matrix to photographing position, means for advancing the matrices and spacers remaining in the line after each matrix or spacer is

displaced therefrom, and means connecting said matrix advancing means and said carrier for coordinate movement by the matrix displacing means to control the movement of the carrier to each successive photographing position.

7. Apparatus for producing type matter photographically from composed matrix lines, comprising a channel to contain the matrix lines, a member for displacing matrices singly and successively from the line into photographing positions, a follower for the matrix line, and a stop connected to the follower and operable by said displacing member to actuate the follower to advance the matrices remaining in the line after the displacement of each matrix therefrom and to correspondingly control the extent of travel of the displacing member.

8. Apparatus for producing type matter photographically from composed matrix lines, comprising a channel to contain the matrix lines, a member for displacing matrices singly and successively from the line into photographing positions, a follower for the matrix line, a travelling stop connected to the follower and operable by said displacing member to actuate the follower, and a relatively fixed stop cooperative with said travelling stop for determining the starting point for the travel thereof.

9. Apparatus for producing type matter photographically from composed matrix lines, comprising a channel to contain the matrix lines, a member for displacing matrices singly and successively from the line into photographing positions, a follower for the matrix line, a travelling stop connected to the follower and operable by said displacing member to actuate the follower, a relatively fixed stop cooperative with said travelling stop for determining the starting point for the travel thereof, and means for altering the connection between and thereby adjusting the relative position of the follower and travelling stop.

10. Apparatus for producing type matter photographically from composed lines of matrices and spacebands, comprising a channel to contain such lines, means for expanding the spacebands to justify the lines in the channel and for maintaining the spacebands in justifying condition, means for displacing the matrices and spacebands singly and successively from the line and for bringing the matrices into photographing positions, means for advancing the matrices and spacebands remaining in the line after the displacement of each matrix and spaceband therefrom, means connected to said matrix advancing means and controlled thereby for measuring the thicknesses of the spacebands in their line-justifying condition prior to their displacement from the line, and means connected to said matrix advancing means for locating the displaced matrices in photographing positions corresponding with the positions occupied by such matrices in the line prior to their displacement therefrom.

11. In apparatus of the character described, the combination of a channel to contain a composed line of matrices and spacebands, the spacebands having bevelled side edges, and matrix displacing means movable transversely of said channel and having hooks engageable with the side edges of the matrices to displace them from the line into photographing positions, the bevelled side edges of the spacebands being operative to deflect the hooks and avoiding displacement of the spacebands thereby.

12. Apparatus for producing type matter

photographically from composed lines of character bearing matrices and expansible spacebands, comprising a channel to contain such lines, means operative to displace the matrices and spacebands singly and successively from the line and to move the matrices into successively located photographing positions relatively to a sensitized surface, means for expanding the spacebands to justify the lines prior to the displacing operation, means associated with the spaceband expanding means for retaining the spacebands in justified condition during the displacing operation, a follower for advancing the matrices and spacebands remaining in the line after each displacement operation, and devices connected to said follower and operable by the displacing means for actuating said follower to thereby determine the photographing positions to which the respective matrices are moved.

13. Apparatus for producing type matter photographically from composed lines of matrices and expansible spacebands, comprising a channel to contain such lines, means for displacing the matrices and spacebands singly and successively from the line and for moving the matrices into different successively located photographing positions relative to a sensitized surface, justifying means for expanding the spacebands and for retaining them in justified condition during displacement of the matrices, a follower for advancing the matrices and spacebands remaining in the line after each displacement thereof, a stop connected to said follower for measuring the thickness of each spaceband while retained in justified condition and prior to its displacement, and means operable by the displacing means to release a spaceband after such measurement, said stop being controlled by said follower and movable by the displacing means at each operation thereof to the respective successively located photographing positions.

14. Apparatus for producing type matter photographically from composed lines containing character bearing matrices varying in thickness according to the widths of the characters thereon and justified by expansible spacebands, comprising means for displacing the matrices and spacebands singly and successively from the line and for moving the matrices different distances therefrom into successively located photographing positions, means for retaining the spacebands in justified condition during displacement of the matrices, a follower for advancing the matrices and spacebands remaining in the line after each displacing operation, and a stop connected to said follower and movable by said displacing means at each operation thereof, said stop being operable to limit the movement of the displacing means under control of said follower according to the respective thicknesses of the matrices and of the spacebands in their justified condition and to locate the matrices at each successive photographing position corresponding to their justified positions in the line.

15. In apparatus for producing type matter from composed lines of character-bearing elements having body thicknesses proportioned to the setwise widths of the characters carried thereby, the combination of, means for holding a composed line of said character-bearing elements, means for successively removing in order the elements from the line to positioning means determining a reproducing position, reproducing means for reproducing in line the characters of said elements as they are removed, and means

for progressively moving said positioning means with respect to said reproducing means amounts proportioned to the body thicknesses of the successively removed character-bearing elements to determine the line positions of the reproduced characters.

16. In apparatus for producing type matter from composed lines of character-bearing elements having body thicknesses proportioned to the setwise widths of the characters carried thereby, the combination of, means for holding a composed line of said character-bearing elements, means for successively removing in order the elements from one end of the line to positioning means determining a reproducing position, means for closing said composed line as said elements are removed, said means determining a reproducing position including a movable stop movable by and in proportion to the movement of said line-closing means, whereby said reproducing position is adjusted for each element removed from the line, reproducing means for reproducing in line the characters of the elements successively moved to the reproducing position, said apparatus acting to control the location of said reproduced characters with respect to each other in accordance with the body thicknesses of the elements.

17. In apparatus for producing type matter from composed lines of character-bearing elements having body thicknesses proportioned to the setwise width of the characters carried thereby, the combination of, means for holding a composed line of said elements including relatively movable jaws for clamping a composed line of elements therebetween, means for successively removing in order the elements from one end of the line to positioning means determining the reproducing position of each element, means responsive to the progressive closing of said jaws caused by the progressive removal of said elements from the line to progressively move said positioning means in proportion to the body thicknesses of the elements removed, reproducing means for successively reproducing in line the characters of the elements presented to said positioning means, and the progressive movement of said positioning means determining the location of said characters reproduced in line from the body thicknesses of said elements.

18. In apparatus for photographically producing type matter from composed lines of character-bearing elements having body thicknesses proportioned to the setwise width of the characters carried thereby and of expansible spacer elements, the combination of, means for holding a composed line of said elements including relatively movable jaws for clamping a composed line of elements therebetween, means for adjusting the maximum distance between said jaws to the length of the line to be reproduced, means for expanding said expansible spacer elements to justify the composed line to the maximum distance between said jaws, means for successively removing in order the elements from one end of the line to a photographing position with respect to photographing means including a sensitized surface on which the characters of said elements are reproduced in line, means responsive to the shortening of said line caused by the progressive removal of the elements therefrom for relatively moving said photographing position and said sensitized surface in accordance with the body thicknesses of the elements removed to locate the reproduced characters in said repro-

duced line, and means for holding the expansible spacer elements in the composed line in their expanded justifying condition during the shortening of said line caused by the progressive removal of the elements therefrom.

19. In apparatus for photographically producing type matter from a composed line of character-bearing elements having body thicknesses proportioned to the widths of the characters borne thereby and expansible spacer elements; the combination of, means for holding such a composed line including a stationary jaw and a movable jaw opposing said stationary jaw and normally adapted to urge a composed line of said elements firmly against said first jaw, movable positioning means for positioning elements removed from said composed line with reference to photographing apparatus for reproducing in line the characters of said elements as they are successively presented to said positioning means and said photographing apparatus, means for mechanically connecting said movable positioning jaw so that movement of the one causes a precise corresponding movement of the other, a stop for limiting the movement of said movable positioning means in one direction and locating said movable positioning means in a position corresponding with the beginning of the reproduced line and also determining the maximum distance between said jaws to determine the justification length of said composed line, means for expanding the spacer elements of said composed line while said jaws are thus held with the maximum distance between them, means for subsequently successively removing in order the elements from the line to said movable positioning means and said movable positioning means progressively moving with respect to said photographing apparatus as said movable jaw moves toward said fixed jaw as said elements are progressively removed from said line.

20. The photographic method of reproducing a line of type matter on a sensitized surface from a font of photographable character-type bearing elements having predetermined dimensions proportioned to the width values of the characters thereon, comprising, composing a line of said elements, positioning one of said elements of said composed line of elements with its character in photographic position in the front focal plane of a camera carrying said sensitized surface, said photographic position being determined by the position of the optical system of the camera, photographing the character of said element on said sensitized surface, moving said optical system along a line while maintaining said sensitized surface stationary, a selected distance proportional to the said dimensions of said element and repeating said positioning, photographing and moving steps for each of the characters in the order of their composition to reproduce in line

on said sensitized surface the characters of each of said composed line of elements, the space relation between said reproduced characters being determined by the moving of said optical system as described.

21. The photographic method of reproducing a line of type matter on a sensitized surface from a font of photographable character-bearing elements having body thicknesses proportioned to the setwise width of the characters thereon, comprising, composing a line of said elements, removing one character-bearing element from said composed line of elements and transferring it into a photographic position in the front focal plane of a camera carrying said sensitized surface, said photographic position being determined by the position of the optical system of said camera, photographing the character of said elements on said sensitized surface, moving said optical system along a line while maintaining said sensitized surface stationary, a selected distance proportional to the said body thickness of said element, and repeating the removing and transferring, photographing and moving steps for each of the characters in the order of their composition to reproduce in line on said sensitized surface the characters of each of said composed line of elements, the space relation between said reproduced character being determined by the moving of said optical system as described.

22. The photographic method of reproducing a justified line of type matter on a sensitized surface from photographable character-bearing elements, the thickness values of which are proportioned to the width values of the characters thereon, comprising, composing a line of said elements, justifying the composed line with spacer elements, removing one character-bearing element from said composed line of elements and transferring it into a photographic position in the front focal plane of a camera carrying said sensitized surface, said photographic position being determined by the position of the optical system of said camera, photographing the character of said element on said sensitized surface, moving said optical system along a line, while maintaining stationary said sensitized surface, a selected distance proportional to the said body thickness of said element, and repeating the removing and transferring, photographing and moving steps for each of the character-bearing and spacer elements in the order of their composition to reproduce in line on said sensitized surface the characters and blanks of each of said composed line of elements, the space relation between said reproduced character being determined by the moving of said optical system as described.

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