

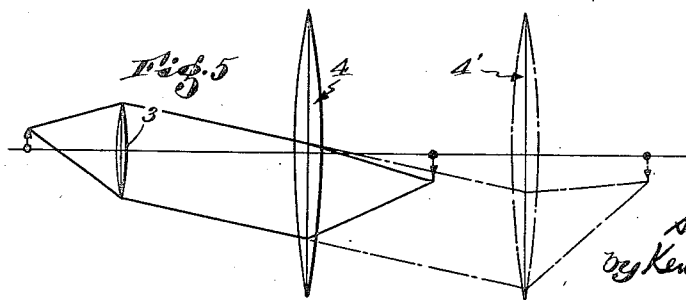
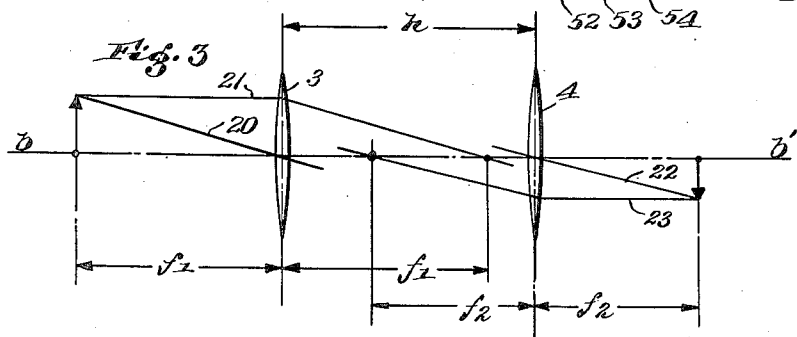
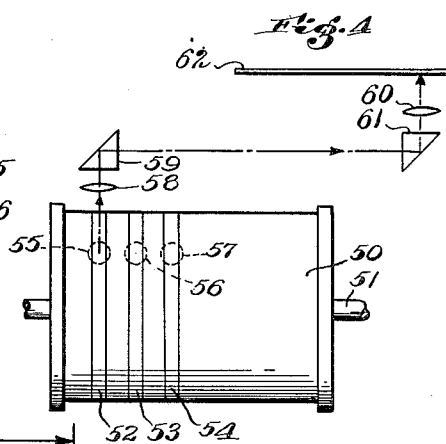
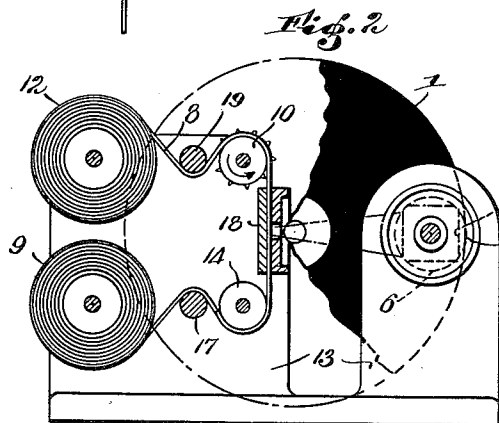
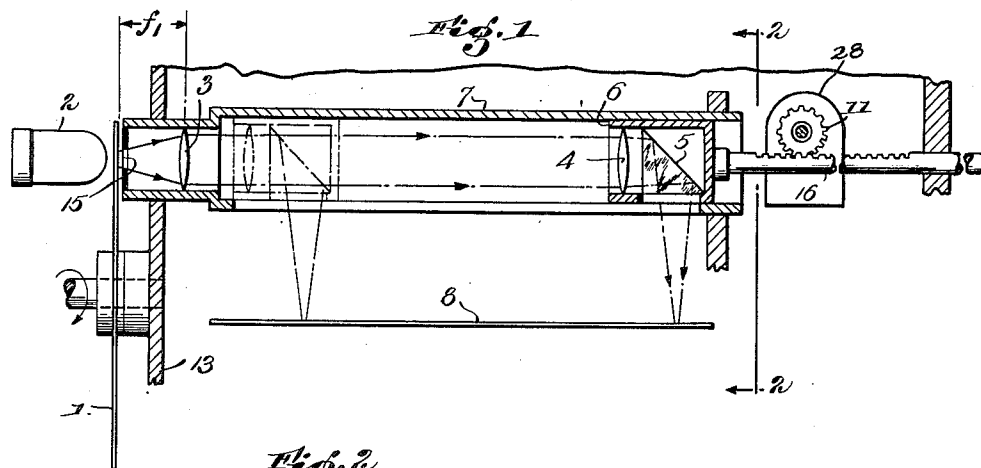
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OPTICAL SYSTEM FOR PHOTOGRAPHIC COMPOSING APPARATUS

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OPTICAL SYSTEM FOR PHOTOGRAPHIC
COMPOSING APPARATUS

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5 Claims. (Cl. 95-4.5)

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This invention relates to photographic composing apparatus, and more particularly to apparatus for projecting the selected characters upon a sensitized material.

A necessary function of such apparatus is to cause relative motion between the projected character images and the sensitized surface. This motion usually depends upon the widths of the characters and upon the increments to be added between words and characters to justify the line. This motion must also be performed with speed and precision commensurate with the desired accuracy in the alignment of character projections.

Hitherto, and for example as shown in the pending application of Higonet and Moyroud, Serial Number 610,336, filed August 11, 1945, the optical system used for character projection has been held stationary, and the carriage on which the sensitized material is mounted is moved at discrete times both to bring about spacing between successive projected characters and words, herein called "character spacing," and to bring about spacing between successive lines, herein called "line spacing." The requirement of speed, particularly where the motion is intermittent, places a premium on light construction; but this objective is in conflict with the requirement of accuracy of positioning which places a premium on sturdy construction.

An object of the present invention is to provide apparatus for character spacing which requires only the movement of lightweight, low-inertia elements.

A further object is to provide apparatus for character spacing which is adapted to any appropriate mechanical means for producing translatory motion, whether or not the motion is a multiple of some unitary distance.

A further object is to provide apparatus for character spacing which can be used either to produce undistorted projected images, or to distort the projected images to produce other shapes of type.

According to the present invention the function of character spacing is performed within the optical system itself, the respective elements of which are made relatively movable. The support which carries the film moves only for the purpose of line spacing. The optical system is designed, in a manner to be hereinafter described, to utilize the properties of a collimating lens.

With the above objects in view, other features of the invention comprise certain features of

construction and modes of operation hereinafter described and particularly defined in the claims.

In the accompanying drawings Fig. 1 is a sectional elevation of the apparatus; Fig. 2 is an end elevation through section 2-2 of Fig. 1, showing in addition a preferred form of film support; Fig. 3 is a diagrammatic representation of the relationship between lenses 3 and 4; Fig. 4 is a schematic representation of a form of the invention employing a drum as the character carrier; and Fig. 5 is a diagrammatic representation of means for insuring uniform brilliance of projected images.

In Fig. 1 the matrix disc 1 is rotatably mounted on a frame, shown in part at 13, and carries the characters to be projected successively past a stationary character aperture 15. The characters are disposed in a circle on the disc. The flash or illuminating device 2 is preferably of the type described in the copending application of Higonet and Moyroud, Serial No. 610,336, filed August 11, 1945, whereby a flash occurs at the precise instant that the selected character on the disc is in position to be projected, this position being in front of the character aperture 15. The flash or illuminating device is preferably controlled by a register in which all the characters of a line are stored before projection, and means are actuated by the register to select the successive stored characters for projection.

Rigidly mounted on frame 13 is a lens support 7, which may be as shown, in the form of a hollow tube with the character aperture 15 at one end. Mounted in the lens support 7 is a collimating lens 3 of focal length f_1 , the position of which is such that the characters on the rotating disc are in its focal plane.

Slidably mounted in the lens support is a translating lens combination comprising a converging lens 4 of focal length f_2 and a right angle reflecting prism 5, both fixedly attached to a sliding mount 6. The function of prism 5 is to reflect the projected image so that it falls at right angles upon a sensitized surface 8. Any suitable reflecting device, such as a pentaprism or a mirror may be used in place of the prism 5. A rod 16 is attached to sliding mount 6 and carries a rack meshing with the teeth of a pinion 11, rotatably mounted on the frame 13. The pinion is provided with means, shown diagrammatically at 28, to cause rotation at discrete times by angles proportional to the desired spacing between successive projections. Means performing such a function are disclosed in the pending applica-

tion of Higonnet and Moyroud, Serial No. 610,336, filed August 11, 1945. The variable advance mechanism there used is limited to movements which are multiples of a unitary movement. It will be clear, however, that the present invention is not limited to such means, and can be driven by steps of any desired size.

It is necessary that sensitized surface 8 falls in the plane of focus of lens 4. The exact determination of this position must take into account the passage of the converging rays through glass, as will be clear to those familiar with this art.

In Fig. 2, the sensitized surface 8 is shown in the form of a film wound over two spools 9 and 12. The spools are rotatably mounted on the frame 13. The film 8 passes from spool 9, around idler wheels 17 and 14, through a channel in a guide 18, fixedly mounted on frame 13 and provided with an exposure slit to receive projected characters, around a toothed driving sprocket 10, an idler wheel 19, and onto take-up spool 12. A cover, not shown, protects the film from exposure except through the slit in guide 18. Driving sprocket 10 may be actuated at suitable times to cause line-spacing.

The optical system above described must have certain properties which cause it to move the successive projections along the sensitized surface without distortion or change in size. That these properties may be obtained is made clear by an examination of Fig. 3. Lenses 3 and 4, separated by a distance h , are shown on a common central axis $b-b'$. The focal distances of the respective lenses are measured off on the line $b-b'$ from their centers. The character to be projected is shown as an arrow in the focal plane of lens 3. When the character is illuminated the rays emerging from any part thereof, say, for example, the tip of the arrow, will be pointed in all directions. The effect of the lens upon two particular rays is immediately apparent. Ray 20, passing through the center of the lens, is not bent because it passes through two parallel surfaces. (For purposes of this description it is assumed that the lens is thin enough that the linear shift in the ray may be neglected.) Ray 21, being parallel to central axis $b-b'$, will be bent so that it will pass through the focus on the other side. By construction, it is seen that these two rays emerge from lens 3 parallel to each other. Similarly, all other rays emerging from the tip of the arrow and passing through lens 3 will be parallel to these rays.

Of all the rays emerging from the tip of the arrow and passing through lens 3 a number will also pass through lens 4, provided that lens 4 is not so far removed from lens 3 that none of the rays will impinge upon it. The effect of lens 4 upon two of these rays is immediately apparent. Ray 22, passing through the center of the lens, is not bent, since it passes through two parallel surfaces. Ray 23, passing through the focus of the lens, will emerge therefrom parallel to axis $b-b'$. Rays 22 and 23 are seen by construction to converge upon a point in the focal plane of lens 4. Similarly, all other rays emerging from the tip of the arrow will focus at the same point if they pass through lens 4.

A ray emerging from the focal point of lens 3 and traveling along axis $b-b'$ will be bent by neither lens because it passes through parallel surfaces. Hence, it will pass through the focal point of lens 4. So also will all other rays emerging from the base of the arrow.

It may be seen by construction that the image is inverted, and the resultant magnification of the image is equal to the ratio of the respective focal lengths. Also, the distance h has no effect upon the distance from lens 4 at which the image will focus. This distance and the magnification remain constant with variable h .

The introduction of prism 5 at a point within the focal length of lens 4 reflects the rays, which are at this point converging, to cause them to converge upon the sensitized surface 8.

From an examination of Fig. 3, it is evident that if the diameters of the lenses 3 and 4 are equal there will be a diminution in the brilliance of the character images as the lens 4 is moved away from the lens 3. This is caused by the fact that, although all of the rays emanating from a particular point in the object and passing through the lens 3 will be parallel to each other, they will not be horizontal. It is further evident that the angle which the parallel rays make with the horizontal increases with the distance of the point in the object from the optical axis. As the lens 4 moves away from the lens 3, it will collect an ever decreasing part of the pencil of rays emanating from a particular point in the object. The resulting effect is to vary the effective exposure on the film from one end of the line to the other.

In Fig. 5, apparatus is shown whereby it is possible to eliminate the changes in brilliance of the images above mentioned. This is done by using a lens 4 of larger diameter than the lens 3, whereby the lens 4 receives substantially the complete bundle of rays from the collimating lens 3, regardless of the distance between lenses. Two positions of the lens 4 are shown, one at 4 in full lines, the other at 4' in dash lines. For the dimensions of the object and lenses shown, the substantial limit of the range of movement for uniformity of illumination is indicated at 4'. In view of the latitude of the film and the fact that gradations of density in the photographic image are not required, some extension of the range is possible.

Since polychromatic light will usually be employed, it is desirable that the lenses be at least partially corrected for color, but simple achromats will usually suffice. In other respects, a high degree of correction is not required. This follows from the fact that each lens has either its image or object at or near infinity. The lenses may be of very large apertures. As is evident from Fig. 5, only a small part of the covering power of the converging lens is used, and the aberrations which are important in camera lenses are not of primary concern in the present invention.

It will be understood that the characters will be so disposed on the disc that the inversions effected by the lenses and the prism will produce images with correct orientation on the film, as will be clear to those familiar with this art.

Since the magnification of the system is equal to the ratio of the focal lengths, a simple method of changing the type size of the projections without changing the sizes of characters on the matrix disc is to replace either lens, making proper adjustments to take account of the new focal distances. In the form of the invention shown in Fig. 1 the simplest method is to replace lens 3.

If it is desired to produce a distortion of the projected characters the prism may be turned to cause the projections to impinge upon sensitized surface 8 at angles less than or greater

than ninety degrees. This will take the resultant focal plane out of coincidence with the sensitized surface, and will cause it to intersect the surface in only one line. The result will be to produce shrinkage in a particular dimension relative to the dimension at right angles thereto. If the focal length f_2 is long enough, the edges of the projections will not become noticeably out-of-focus.

An alternative embodiment of the invention, as shown in Fig. 4, comprises a rotating character drum 50 mounted on a shaft 51. Bands of characters 52, 53 and 54, each band representing a different font, are placed around the drum. Flash lamps 55, 56 and 57 are fixedly mounted in position to project the characters of a particular font. A lens 58, a collimating lens corresponding to lens 3 in Fig. 1, is fixedly mounted with a prism 59, the combination being movable along the axis of the lens mount to select the font to be projected. A prism 61, a lens 60 and a sensitized surface 63, correspond to prism 5, lens 4 and sensitized surface 8 in Fig. 1. The advantage of the arrangement resides in the ease with which the font may be changed due to the lightness of the movable elements associated therewith.

It will be understood that while simple lenses have been shown in the diagrams, the apparatus will employ lenses suitably corrected in accordance with well-known optical principles.

Having thus described the invention, I claim:

1. In photographic type composing apparatus, the combination of a collimating lens, means for putting in the focal plane of the collimating lens an image of the character to be projected, an illuminating device to project the images of selected characters forming a line successively through the collimating lens, each character having a predetermined width value and being projected while it is in the projection position, a translating lens combination including a converging lens and a reflector arranged one behind the other to focus the projected light and reflect it through a predetermined angle, a support to hold a sensitized surface in substantial coincidence with the focal plane of the light leaving the lens combination, and means for displacing the lens combination relative to the collimating lens and longitudinally of the surface after each projection by variable distances proportional to the widths of the corresponding characters, whereby each character is focused upon the surface irrespective of the relative positions of the two lenses.

2. In photographic type composing apparatus, the combination of a collimating lens, a matrix disk revolving about a fixed axis bearing a plurality of characters arranged in a circle lying in the focal plane of the collimating lens and having its center in the said axis, whereby the characters are moved through a projection position, an illuminating device to project the images of selected characters forming a line successively through the collimating lens, each character having a predetermined width value and being projected while it is in the projection

position, a translating lens combination including a converging lens and a reflector arranged one behind the other to focus the projected light and reflect it through a predetermined angle, a support to hold a sensitized surface in substantial coincidence with the focal plane of the light leaving the lens combination, and means for displacing the lens combination relative to the collimating lens and longitudinally of the surface after each projection by variable distances proportional to the widths of the corresponding characters, whereby each character is focused upon the surface irrespective of the relative positions of the two lenses.

3. In photographic type composing apparatus, the combination of a drum revolving about a fixed axis, a number of circular bands of characters disposed upon and relatively displaced longitudinally of the drum, each band corresponding to a different font, a first optical system comprising a collimating lens and a first reflector in fixed relation, said optical system being movable in a line parallel to said axis to select the desired band, whereby the characters in the selected band pass successively through the focal plane of the collimating lens, an illuminating device to project the images of selected characters forming a line successively through the collimating lens, each character having a predetermined width value and being projected while it is in said focal plane, a second optical system comprising a converging lens and a second reflector arranged one behind the other to focus the projected light and reflect it through a predetermined angle, a support to hold a sensitized surface in substantial coincidence with the focal plane of the light leaving the second optical system, and means for displacing the second optical system relative to the first optical system and longitudinally of the surface after each projection by variable distances proportional to the widths of the corresponding characters, whereby each character is focused upon the surface irrespective of the relative positions of the two optical systems.

4. Apparatus as defined in claim 1 in which the converging lens is of larger diameter than the collimating lens, whereby the image is illuminated in a substantially uniform manner over the range of relative displacement of the lenses.

5. Apparatus as defined in claim 3 in which the converging lens is of larger diameter than the collimating lens, whereby the image is illuminated in a substantially uniform manner over the range of relative displacement of the lenses.

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