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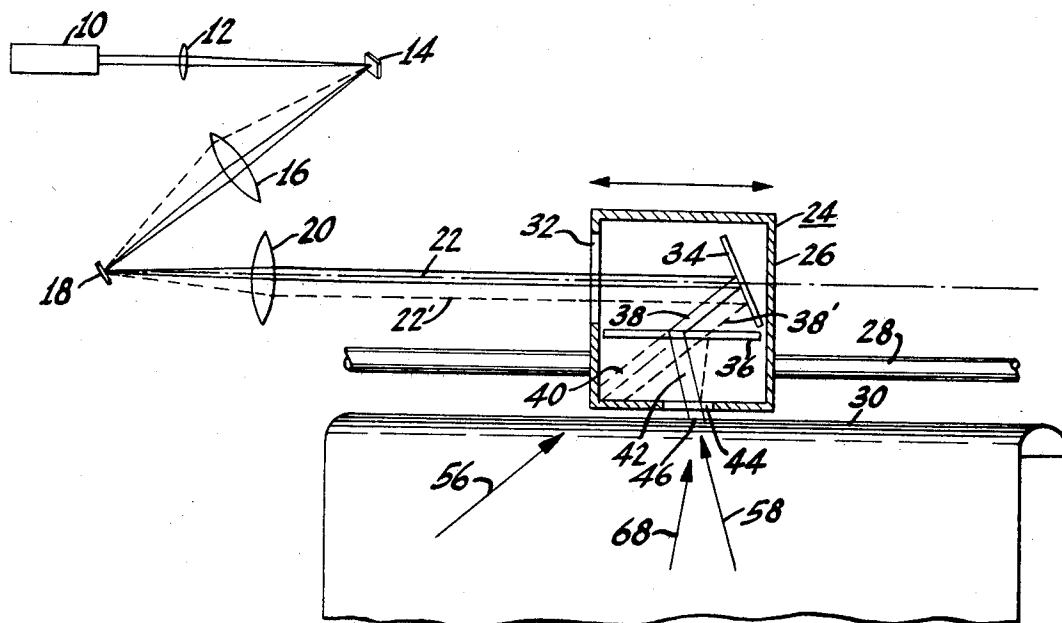
[54] **PHOTOCOMPOSING APPARATUS**
5 Claims, 4 Drawing Figs.

[52] U.S. Cl. **95/4.5**
 [51] Int. Cl. **B41b 21/26**
 [50] Field of Search **95/4.5**

[56] **References Cited**

IBM Tech. Disclosure Bulletin, C. Lanza, vol. 8, No. 11,
 April 1966.
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 No. 11, April 1967.

ABSTRACT: An optical data and display system for use in a photocomposing apparatus or the like. Images of any selected ones of many alphanumeric or graphic characters are successively created and projected onto a photosensitive film at successively spaced points along a line on the film. A matrix of holograms with respective graphic images and a reflector are mounted in fixed relation to each other and are arranged to be movable as a unit in a direction parallel with the surface of the photosensitive film. Light from a laser is reflected from horizontally and vertically rotatable galvanometer mirrors along any one of a plurality of paths which are all parallel with the direction of motion of the hologram-reflector unit. The light beam is reflected by the reflector to the hologram matrix where it illuminates any selected one of the holograms and causes a corresponding graphic image to be projected onto the photosensitive film.



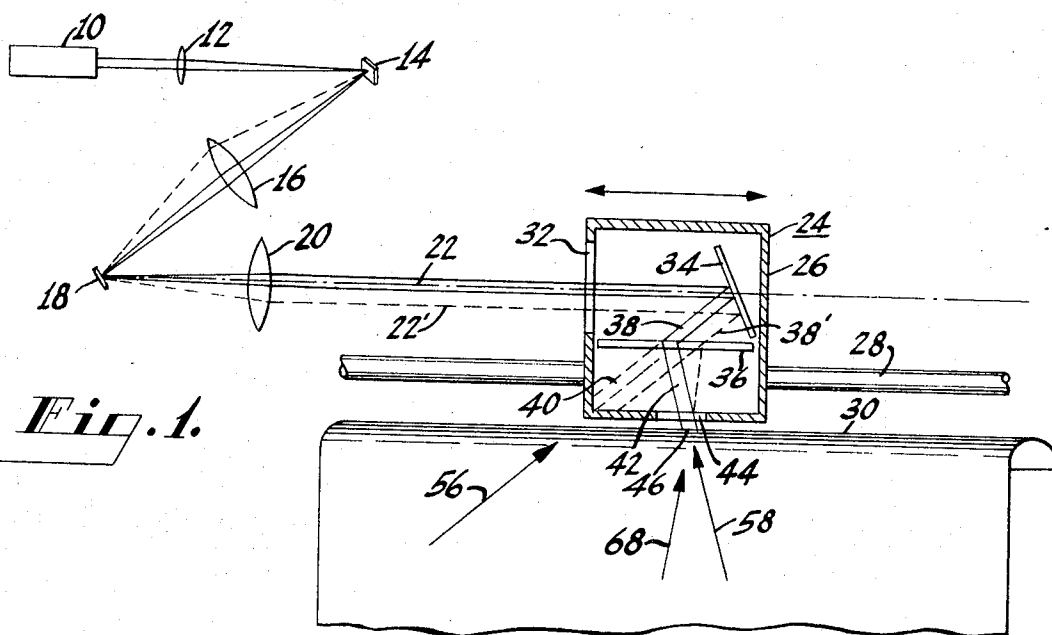


Fig. 1.

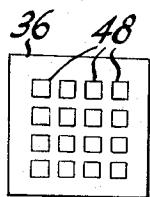


Fig. 2.

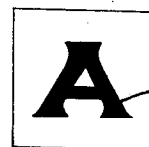


Fig. 3.

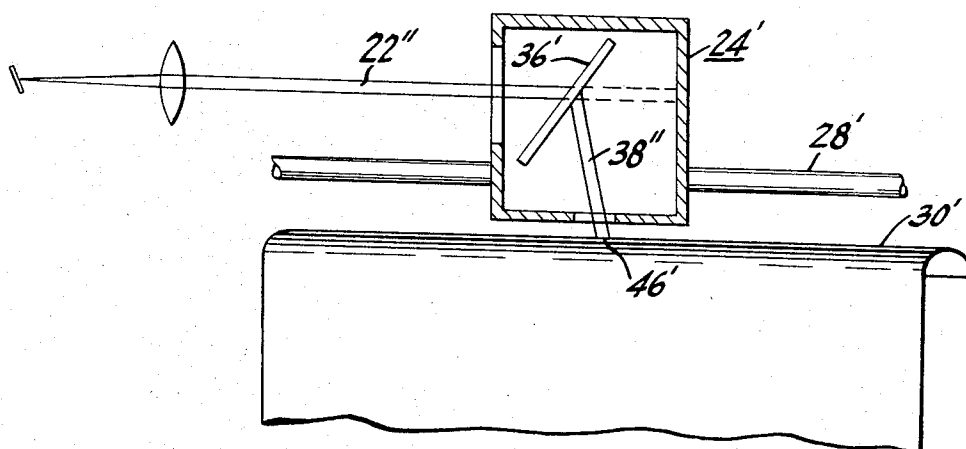


Fig. 4.

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PHOTOCOMPOSING APPARATUS

BACKGROUND OF THE INVENTION

A member of opto-electronic photocomposing or phototypesetting systems have been proposed to replace the linotype machines which have been almost universally employed. The composing process basically involves the repeated selection of any desired one of many alphanumeric characters in any one of a plurality of fonts, and the positioning of the selected character in an appropriate place along a line. One successful prior art photocomposing system includes a computer having a random-access core memory storing binary information from which any desired alphanumeric character can be created by a scanning motion on the phosphor screen face of a cathode ray tube. The deflection system of the cathode ray tube permits the selected character to be positioned at any desired point along a line on the face of the tube. The alphanumeric characters thus produced on the face of the cathode ray tube are imaged on a photographic film which, after development, is used to make a printing plate by photoengraving or other process.

A number of other photocomposing systems have been proposed utilizing various combinations of mechanical, optical and electronic components. However, all of the existing and proposed photocomposing systems leave something to be desired in regards to cost, speed of operation, or practical feasibility. It is therefore a general object of this invention to provide an improved optical data selection and display system which is particularly economical to construct and operate, and which is capable of implementation with presently-existing elemental component parts.

BRIEF SUMMARY OF THE INVENTION

In accordance with an example of the invention for successively projecting images along a line on a record, a matrix of holograms corresponding with graphic images is mounted for movement in a direction parallel with the surface of the record. Means are provided to deflect a light beam along any one of a plurality of paths all parallel with the direction of motion to any selected one of the holograms of the matrix. The holograms of the matrix are constructed so that when the hologram matrix unit is in a given position relative to the record, the illumination of any selected hologram results in a corresponding graphic image at the same place on the record.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a simplified diagram illustrating a phototypesetter system constructed according to the teachings of this invention;

FIG. 2 is a representation of a hologram matrix including a number of characters representing individual holograms arranged in rows and columns and suitable for use in the system of FIG. 1;

FIG. 3 is a representation of the image of a character created by an illuminated one of the holograms in the matrix of FIG. 2; and

FIG. 4 is a simplified diagram illustrating a modified embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Reference is now made in greater detail to the phototypesetter or photocomposing system shown in FIG. 1. Light from a laser 10 or other source of an intense light beam is directed through a lens 12 to a horizontally rotatable mirror 14 of a mirror galvanometer. The beam reflected from the galvanometer mirror 14 is directed through a lens 16 to a vertically rotatable galvanometer mirror 18. The lens 16 is constructed and positioned so that the horizontal deflection beam leaving the galvanometer mirror 14 is directed to a central point on the galvanometer mirror 18. The galvanometer mirror 18 adds any desired vertical deflection to the already

horizontally deflected beam and directs a doubly deflected beam to a lens 20, from which the beam travels along any one of many parallel paths toward a movable unit 24.

In the construction of the optical deflection system thus far described, the distance from the lens 12 to the galvanometer mirror 14 is made equal to the focal length of the lens 12 so that the beam from the lens 10 is concentrated at a small spot on the galvanometer mirror 14. The distance between the galvanometer mirrors 14 and 18 is made equal to four times the focal length of the lens 16 so that the beam is concentrated at a small spot on the galvanometer mirror 18. The lens 20 is made to have a focal length such that the deflected beam leaving the lens 20 follows a corresponding one of many parallel paths.

The solid lines extending from the laser 10 through the lenses and mirrors to the unit 24 represent the boundaries of a light beam when the galvanometer mirrors 14 and 18 are in their midpositions not imparting horizontal and vertical deflections to the beam. The dashed line represents the path of a light beam when the galvanometer mirror 14 is positioned to provide a maximum amount of horizontal deflection, in one direction from the center, of the beam, and the galvanometer mirror 18 is positioned to provide an appreciable amount of vertical deflection to the light beam.

The described optical deflection system employing galvanometer mirrors is a known system and it will therefore not be described in greater detail here. An improved and advantageous optical deflection system suitable for use in the system of FIG. 1 is described in a patent application entitled "Optical Data Selection and Display" filed by Philip J. Donald on July 26, 1967, and assigned to the assignee of the present application.

The unit 24 includes a housing 26 mounted for reciprocation on guide rails 28 which are disposed parallel with the surface of a photosensitive film 30. The film 30 is movable by means not shown in a direction perpendicular to the direction of guide rails 28. The unit 24 is movable along guide rails 28 in the direction of a line of alphanumeric characters to be projected onto the photosensitive film or record 30. The direction of movement of unit 24 on guide rails 28 is thus parallel with the surface of film or record 30 and is also parallel with the light beams 22, 22' directed to the unit 24.

The enclosure 26 of the unit 24 has an opening 32 through which the light beam 22 passes in going to a plane reflector 34 or other equivalent means for changing the direction of the light beam. A matrix 36 of holograms is mounted in the enclosure 26 in fixed angular relation with the reflector 34. The light beam 22 is reflected from reflector 34 along a path 38 to an individual hologram on the matrix 36. The light passing directly through the hologram along the path 40 is absorbed in the enclosure 26. Light also passes from the illuminated hologram along a path 42 through an opening 44 in the enclosure 26 to form a corresponding alphanumeric character image at 46 on the surface of the film or record 30.

The hologram matrix 36 may, as shown in FIG. 2, consist of a photographic film or transparency provided with individual holograms 48 arranged in rows and columns. The illumination of an individual hologram results in the creation at 46 of a corresponding graphic image such as the image 50 shown in FIG. 3. Only one hologram 48 of the matrix 36 is illuminated in any given instant of time to create the corresponding graphic image.

The hologram matrix 36 is initially constructed by positioning an unexposed photographic plate at the position of matrix 36 in FIG. 1. Means (not shown) are arranged to project light onto the unexposed film in a relative direction 56, which is opposite to the direction 38 of light from the mirror 34 during subsequent operation of the system. In constructing the hologram, light is also simultaneously projected in the direction 58 through an actual graphic image transparency at 46 to the unexposed film at 36. The light from the two directions 56 and 58 is preferably supplied with the aid of a mirror (not shown) from a single laser source. A diffusing plate and a mask are

also positioned between the unexposed film and the light paths 56 and 58. An individual hologram is thus recorded on an elemental unmasked area 48 of the film.

By successively positioning graphic characters at the point 46, and repositioning the mask, and appropriately changing the direction of light beam 58, holograms representing different characters are recorded in rows and columns on the film at 36. The exposed film is then photographically developed and later used at 36 in reconstructing the graphic information recorded thereon as corresponding graphic characters on the record or film 30. Further information on holograms is given in an article entitled "Photography by Laser" by E.N. Leith and J. Upatnieks appearing in the June, 1965, issue of Scientific American, pp. 24-35.

In the operation of the system of FIG. 1, electrical deflection signals are applied to the galvanometer movements (not shown) connected with the galvanometer mirrors 14 and 18 to provide any desired horizontal and vertical deflection of the beam 22. The beam 22 is then incident on the surface of the mirror 34 at a point or small area corresponding in position with the horizontal and vertical deflection imparted to the beam by the galvanometer mirrors. Regardless of the amount of horizontal and vertical deflection of the beam 22 (within the limits of the apertures of lenses 16 and 20) the direction of the beam at 22 is always in a direction parallel with the direction of movement of the unit 24 along the guide rails 28. Therefore, the point on the mirror 34 to which the beam is incident is independent of the position of the unit 24 along the guide rails 28.

The beam 22 is reflected from the mirror 34 along a path 38 to illuminate a single one of the individual holograms on the matrix 36. The particular hologram illuminated is determined by the horizontal and vertical deflection imparted to the beam by the galvanometer mirrors 14 and 18. When the individual hologram is illuminated, a corresponding graphic image is projected along the path 42 to the point 46 on the photographic film 30. If the light beam is deflected to the path 22' by the galvanometer mirrors, the beam is reflected from the mirror 34 along the path 38' to a different hologram on the matrix 36. When this different hologram is illuminated, the resulting graphic image also appears at the same point 46 on the photosensitive film 30. The reason why this second image appears at the same point 46 is that the particular hologram was originally created using a light beam from a direction 68 instead of the direction 58. Each other individual hologram was similarly constructed using an appropriate direction of light so that, in use, the graphic image always appears at 46.

In using the system of FIG. 1, the hologram-reflector unit 24 is moved along the guide rails 28 to expose a line of graphic characters on the photographic film 30. At each spaced point along the line, any desired graphic character is projected onto the film 30. The particular graphic image positioned at any instant of time is determined by the deflection of the beam by galvanometer mirrors 14 and 18 and the resulting one of the holograms in the matrix 36 which is thereby illuminated. After all the graphic characters of a line have been projected in a line on the photographic film 30, the unit 24 is returned to its

starting position at the edge of the film 30 and the film 30 is advanced in a direction perpendicular to the direction of guide rails 28 in preparation for exposing the next following line of graphic characters on the film. After the film has been exposed with a desired number of lines of graphic characters, the film is photographically developed and used for making a printing plate.

FIG. 4 shows a modification of the system of FIG. 1 in which the movable unit 24' does not include a reflector, but instead has the hologram matrix 36' arranged to be directly in the path of the collimated light beam 22''. As before, the light beam 22'' is in a direction parallel with the direction of movement of unit 24' on guide rails 28'. The illumination of any one of the individual holograms on the matrix 36' results in the creation of a corresponding graphic image at 46' on the photosensitive film 30'. The holograms of the matrix 36' are originally created using appropriate directions of exposing light so that the illumination of any one of the holograms always results in the creation of the corresponding graphic image at 46'. In all other respects, the embodiment shown in FIG. 4 is the same as the embodiment shown in FIG. 1.

I claim:

1. Means for successively projecting images along a line on a record, comprising:
 - a matrix of holograms corresponding with graphic images;
 - means to move said matrix of holograms in a direction parallel with said record surface; and
 - means to deflect a collimated light beam along a selected one of a plurality of paths parallel to the direction of motion of the matrix and thence to any selected one of the holograms on said matrix.
2. The combination as defined in claim 1, wherein the holograms of said matrix are constructed so that when the hologram matrix is in a given position along a line on the record, the illumination of any selected hologram results in a corresponding graphic image at the same place on the record.
3. The combination as defined in claim 1, wherein said light beam is applied directly to said matrix of holograms.
4. The combination as defined in claim 1, and in addition a mirror mounted for movement as a unit with said matrix of holograms, and wherein said light beam is directed to said mirror and thence to said matrix of holograms.
5. Means for successively projecting images onto a record along a line on the record, comprising:
 - a matrix of holograms corresponding with graphic images and a reflector both mounted in fixed relation to each other and movable as a unit in a direction parallel with the surface of said record;
 - means to deflect a light beam along any one of a plurality of paths all parallel with said direction of motion to said reflector and thence to any selected one of the holograms of said matrix; and
 - the holograms of said matrix being constructed so that when the hologram matrix and reflector unit is in a given position relative to said record, the illumination of any selected hologram results in a corresponding graphic image at the same place on the record.