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3,458,655 7/1969 Thourson 95/4.5 X
3,518,666 6/1970 Heggestad 340/380
Primary Examiner—John M. Horan

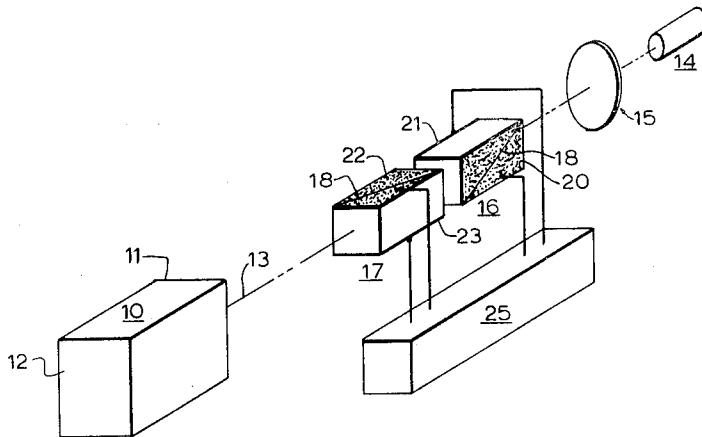
[54] **MESSAGE CHARACTER FORMING APPARATUS**
3 Claims, 7 Drawing Figs.

[52] U.S. Cl. **95/4.5,**
340/378
[51] Int. Cl. **B41b 21/26**
[50] Field of Search **95/4.5;**
340/378, 380

[56] **References Cited**
UNITED STATES PATENTS

2,985,873	5/1961	Anthon	340/378
3,220,013	11/1965	Harris.....	346/107
3,391,970	7/1968	Sincerbox.....	95/4.5 X

ABSTRACT: An apparatus for making records of message characters using a character forming device between a source of light and a record medium, and wherein the forming device lends itself to effecting recordations either while in direct contact with the record medium for making "hard copy" prints, or, through a lens system onto microfilm. The device makes use of a bundle of optical fibers extending from a light admitting surface to a light emitting surface of the device and wherein the fibers are divided into a number of smaller bundles, representing segments with which characters are formed. To form a particular character predetermined ones of the larger bundles are illuminated on the light admitting side of the device, and their corresponding segments will emit light in the form of the desired character on the opposite side, and from which a record is made.



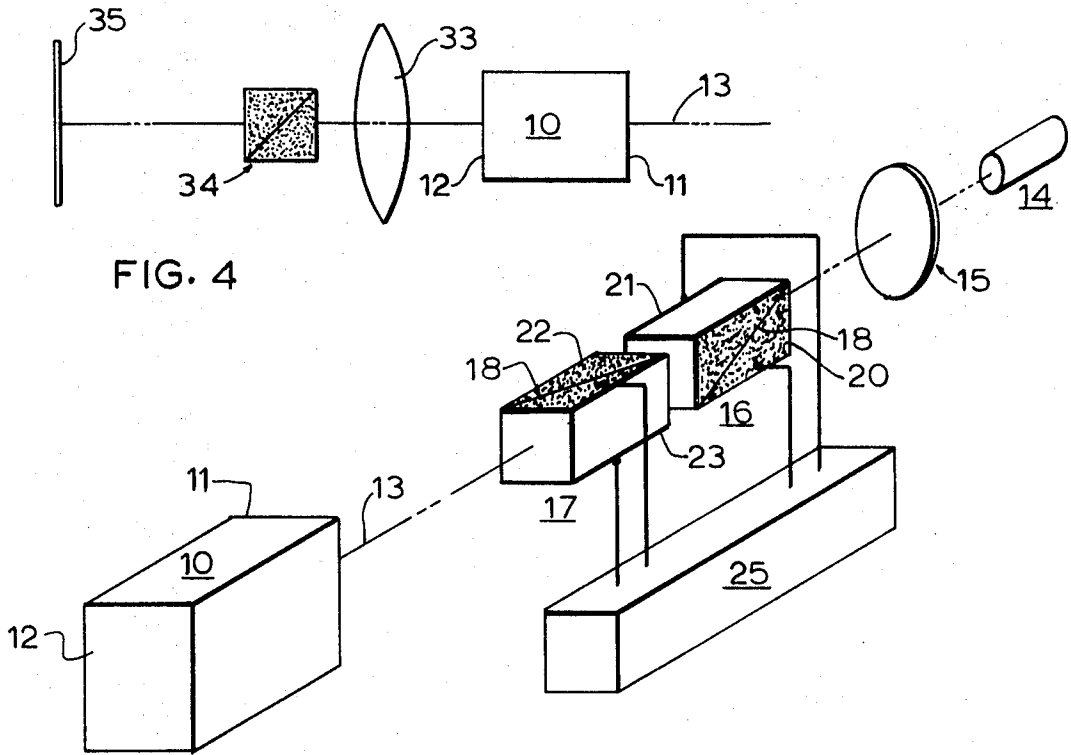


FIG. 4

FIG. 1

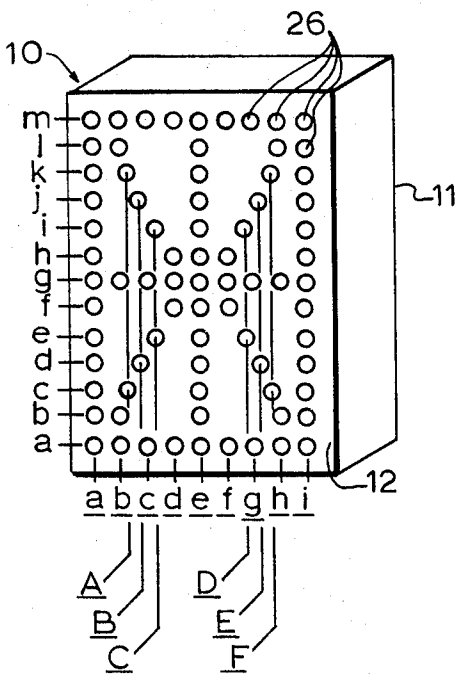


FIG. 2

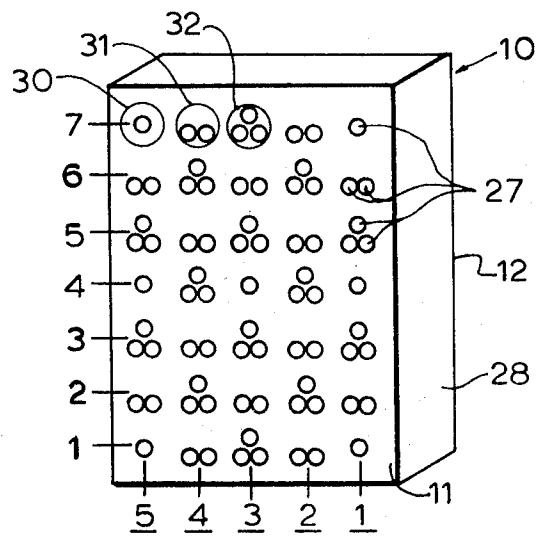


FIG. 3

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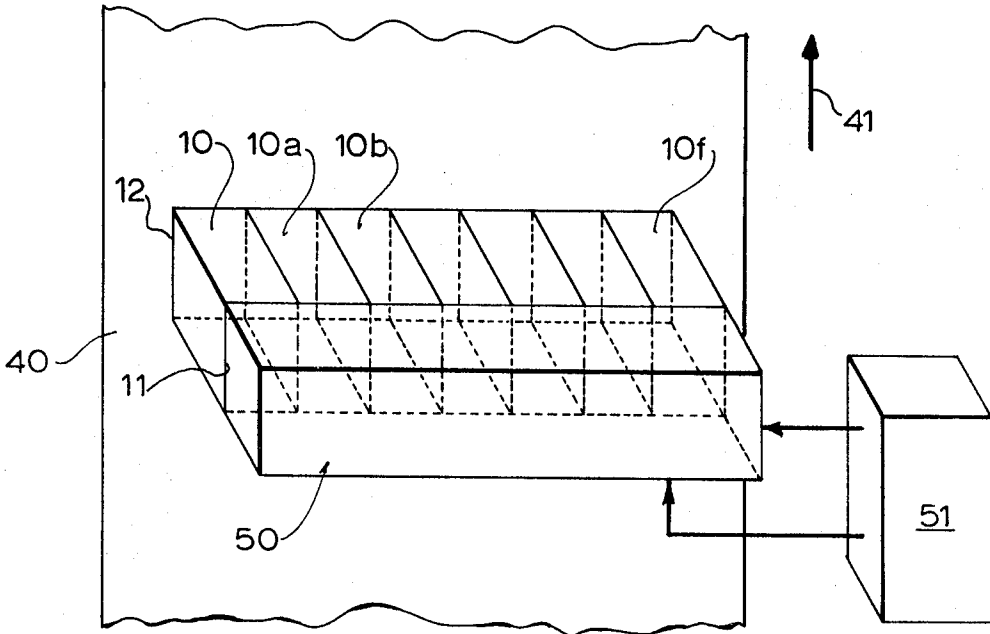


FIG. 5

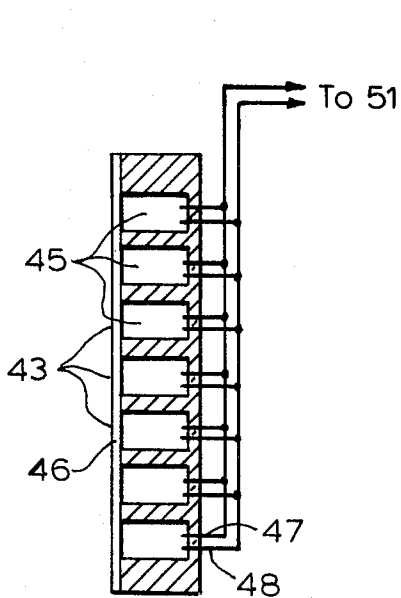


FIG. 7

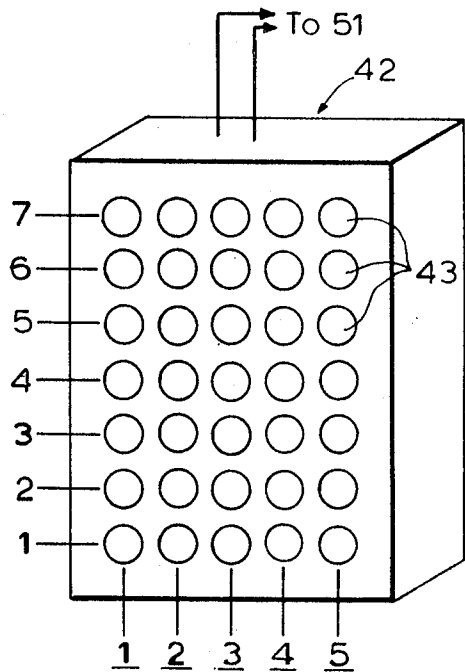


FIG. 6

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MESSAGE CHARACTER FORMING APPARATUS

BACKGROUND OF THE INVENTION

The invention herein pertains to recording apparatus of the type used for printing copy corresponding to coded data available at the output of electronic computers, for example. To a very large extent the cathode-ray tube is satisfying most of the needs in this area as a character generator and display for allowing recordations of printed matter to be made on light sensitive record media, such as microfilm. In most cases the characters generated are composed from an array of dots, or bar segments, which of course provide satisfactorily readable copy. However, in relation to the present invention, cathode-ray tubes and their associated circuitry is expensive, their light output is rather limited and the types of record media required is also relatively expensive for many applications they are called upon to satisfy. The character forming and printing techniques utilized in this invention, therefore, are designed to overcome these shortcomings of CRT methods of character generation and recording.

SUMMARY OF THE INVENTION

Included herein is a character generating means which makes use of segmentally formed letters, numerals, symbols, etc., but the individual segments are composed of dots of light, and accomplished with the use of the light emitting ends of groups of light guides, such as optical fibers. In doing so, segments of characters can be designed to meet a variety of recording requirements totally independent of any stringent generator illumination requirements. This particular means of generating information to be recorded lends itself to either contact printing or projection printing of a substantial variety of message bearing symbols, even though limited in the sense that segmented character forming techniques usually are. Certain objects of the recording apparatus of this invention are to be able to overcome light intensity and record media requirements usually associated with cathode-ray tube systems, for example. Design flexibility inherent in the invention permits the use of a single source of light with deflector means for effecting the generation of characters, or, an array of individual light sources in combination with a system of individual on-off excitation means for accomplishing the recording needs of a given application. Independent of any light source requirement the invention is designed to record an array of significant segments of characters in response to an otherwise much less meaningful array of lights, or light projections, used in connection with the recording of information. Also explained herein will be the ability of the apparatus to use record media of the "hard copy" variety, usually requiring high intensity light, or the more sensitive film when an application calls for the use of a low intensity light source.

The invention, however, both as to this originality and method of operation, and additional objects and advantages, will best be understood from the following description when read with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagram of a system embodiment of the invention;

FIG. 2 and FIG. 3 represent front and rear surface views of a character forming device as used in the FIG. 1 embodiment;

FIG. 4 is a diagram of portions of a system to be combined with that of FIG. 1.

FIG. 5 is a diagram of another system embodiment of the invention;

FIG. 6 and FIG. 7 represent two different views of a source of light that may be used in the embodiment of FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A system embodiment of the invention as shown in FIG. 1 includes a character forming unit 10, presenting a first surface 11 and a second surface 12, supported along an optical axis 13 of the system and in relation to a source of light 14, which may be a LASER light source 14. Intermediate the light source and the unit 10 a lens system 15 is provided for projecting light from the source 14 toward the surface 11, followed by first and second light deflectors 16 and 17, which will be used to direct a beam of light from the source 14 to selected areas of the surface 11. These deflectors are illustrated as comprising a pair of prismatic beam deflectors for effecting horizontal deflections of the beam and a pair for effecting vertical deflections of the beam, each of the prisms being composed of electro-optic crystals, for example, such as barium sodium niobate, and presenting an optic axis perpendicular to the axis 13, and also adjoining angular surfaces 18 intersecting the axis 13. On opposing surfaces, the deflectors 16 and 17 are provided with electrodes 20 and 21, and 22 and 23, respectively, for subjecting them to the influence of an electrical potential from a source of voltage 25. Upon the application of electrical potentials thereto the index of refraction of adjacent prisms will be modified to the extent of effecting the desired horizontal and vertical deflections of the light beam, and consequently, the illumination of selected areas of the surface 11.

Referring now to FIGS. 2 and 3, the character forming unit 10 will be described as containing a bundle of light guides, such as optical fibers, extending from the first surface 11 to the second surface 12 thereof. Light emitting ends 26 of the light guides, at the second surface 12, are fixedly supported in a predetermined array, such as that exemplified in FIG. 2, and the light admitting ends 27 of the light guides, as shown in FIG. 3, are fixedly supported in a somewhat different array. The emitting ends of the second surface 12 are capable of being divided into individual groups, or segments, with which a large number of message bearing characters, such as letters, symbols, etc., can be formed. The light guides of each such group extend through the support medium 28 to the first surface 11 of the unit 10 where the light admitting ends thereof terminate within a predetermined number and array of areas that will be illuminated with light from the source 14. As shown in FIG. 3, these areas, such as 30, 31, 32, etc., are arranged in five columns and seven rows, and within each area there is shown to be one, two or three light admitting ends 27. This five by seven array of areas is, of course, illustrative. Other arrangements may be used, such as a single row of 35 areas. In any event, the illumination of one or more areas will illuminate one or more segments of light emitting ends 26 at the second surface 12.

Upon the illumination of selected combinations of the light admitting areas symbols, letters or numerals corresponding to such combinations will be segmentally formed and presented at the second surface 12. Each area, or spot, of light will be converted to one, two or three spots of light at the character forming surface 12. However, these character forming segments may be extended to include more than the number of spots exemplified herein. Other arrangements of character forming segments can be utilized to present a greater variety and array of more distinctive characters in response to the illumination of relatively simplified combinations of light admitting areas at the surface 11 of such a unit 10.

Cross-sectional dimensions of optical fiber material that may be used as the light guides in the unit 10 can be obtained as small as 0.001 in diameter, or less, and to sizes of 0.010, or greater. Therefore, the array of segments in FIG. 2 may not require an area any larger than 0.020 x 0.020, and it can be made as large as an application requires it to be. Referring to FIGS. 2 and 3, the rows and columns of the admitting ends and the emitting ends can be related as follows, and an example of how characters are established is also shown.

Emitting ends		Admitting ends		A	B	C	D	E	F
Row	Column	Row	Column						
m	a	7	1					o	o
lk	aa	6	1	o	o			o	o
jih	aaa	5	1	o	o			o	o
g	a	4	1	o	o			o	o
fed	aaa	3	1	o	o			o	o
cb	aa	2	1	o	o			o	o
a	a	1	1	o	o			o	o
mm	cb	7	2	o	o	o	o	o	o
lkj	baB	6	2						
ih	Cd	5	2						
ggg	dcb	4	2	o				o	
fo	dC	3	2						
dcb	BAb	2	2						
aa	cb	1	2		o	o	o	o	o
mmm	fed	7	3	o	o	o	o	o	o
lk	ee	6	3	o	o				
jih	eee	5	3	o	o				
g	e	4	3	o	o	o	o		
fed	eee	3	3	o	o				
cb	ee	2	3	o	o				
aaa	fed	1	3	o	o	o	o	o	o
mm	hg	7	4	o	o	o	o	o	o
lkj	hFE	6	4						
ih	Df	5	4						
ggg	hgf	4	4	o	o				
fo	fD	3	4						
dcb	EFh	2	4						
aa	hg	1	4	o	o	o	o	o	o
m	i	7	5					o	o
lk	ii	6	5	o	o	o	o		
jih	iii	5	5	o	o				
g	i	4	5	o	o			o	
fed	iii	3	5	o	o	o	o		
cb	ii	2	5	o	o	o	o		
a	i	1	5	o	o			o	o

As exemplified above, the letters A, B, C, etc., will be formed on the surface 12 by deflecting a beam of light from the source 14 to those areas 30, 31, etc. necessary to form such characters, and the areas necessary to form a given character will be illuminated sequentially and as rapidly as necessary, or possible. When the beam of light is being deflected in the process of forming a character, predetermined voltages for doing so will be applied to the deflectors 16 and 17 from the source 25, and means, not shown but well known in the art, will of course be used to gate the beam on and off as required.

In the process of recording a line of characters on a record medium the characters will be formed successively and directed in a line across the medium. As shown in FIG. 4, a lens system 33 will project and image characters as they appear on the surface 12, and an electro-optic light beam deflector 34 will be used to position the characters in a line across the record medium 35. Deflectors 34 may be similar to deflectors 16 or 17. However, a line of characters may be recorded on a record medium which is in contact with, and moved in relation to, the surface 12 while the characters are being formed. Or, a number of the units 10 may be supported side-by-side to form a line of individual character forming units adjacent the surface of a record medium. The deflector 17, in addition to directing a light beam to one column and the next of a given unit 10, it will also be used to direct the beam to each of the units in the line.

In the system embodiment of FIG. 5, a line of character forming units 10, 10a, 10b, through 10f are illustrated as being supported adjacent a record medium 40, which is movable in the direction of arrow 41. In this embodiment the light admitting surface 11 of each of the units 10 is illuminated from a light source composed of as many individually controlled sources of light as there are light receiving areas on the surface 11 of each unit 10. One such multiple light source 42 is illustrated in FIG. 6 which indicates that there are 35 areas 43, in a

five by seven array, from which light will be obtained. This arrangement of areas 43 is designed to match the light requirements of the surface 11 in FIG. 3. A section through the light source unit 42 is shown in FIG. 7, and it is shown to include an array of gas cells 45. Each cell contains neon gas, for example, and is viewed through a transparent window 46 when made to glow following the application of a voltage between at least two electrodes 47 and 48. A light source such as this is a development of the Burroughs Corporation, Detroit, Mich., and identified as Self-Scan Panel Display. The operation of the panel is set forth in a Burroughs Corp. Bulletin 1161. It will be noted that the operating characteristics of such a panel lends itself quite well to certain illumination requirements of an assembly of units 10 through 10f in FIG. 5 hereof. However, the multiple light source 42 may be comprised of a five by seven array of light-emitting diodes, such as gallium arsenide phosphide diodes. Or the source 42 may include an array of neon or incandescent lamps.

When in operation a multiple light source 50 in FIG. 5, will be energized from a voltage control source 51 to provide lines of printed data on the medium 40 as it is moved in the direction of the arrow 41. When the surfaces 12 of the units 10 are in direct contact with the medium 40 the actual size of the characters being formed will be recorded, however, a reduced size recording may be made on microfilm, for example, by the inclusion of a lens system between the surfaces 12 and the medium 40.

The particular embodiments of the invention illustrated and described herein is illustrative only, and the invention includes such other modifications and equivalents as may readily appear to those skilled in the arts, and within the scope of the appended claims.

I claim:

1. In a message character forming apparatus

- a. a source of light;
- b. character-segment establishing means, presenting first and second surfaces, including a plurality of light guides each presenting a light admitting end coincident with said first surface and a light emitting end coincident with said second surface;
- c. said first surface containing predetermined number and array of light receiving areas, each area having positioned therein one, or more, of the light admitting ends of said light guides;
- d. said source of light including a plurality of electrically controllable light emitting elements, each element being adjacent to, and limited to the illumination of, a predetermined one of said light receiving areas;
- e. means for extending the influence of an electrical potential, individually, to said light emitting elements so as to effect the illumination of but one (or a number) of said light receiving areas or a number of said light receiving areas simultaneously;
- f. said second surface containing a plurality of array of said light emitting ends, each array comprising one, or more, of said light emitting ends of light guides extending to predetermined ones of said light receiving areas for conducting light therefrom to the light emitting ends of each array, said plurality of arrays representative of a plurality of message characters and each array presenting a significant segment of one (a) message character, or a number of different message characters, upon said effecting of the illumination of the light receiving area thereof;
- g. said array of light receiving areas comprising a predetermined number of columns, and a predetermined number of rows, of areas;
- h. said source of light comprising a plurality of columns of light emitting elements equal in number to said predetermined number of columns of light receiving areas, and a plurality of rows of light emitting elements equal in number to said predetermined number of rows of light receiving areas;
- i. said plurality of arrays of light emitting ends comprising a plurality of columns of light emitting ends equal in

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number to said predetermined number of columns of light receiving areas, and a plurality of rows of light emitting ends equal in number to said predetermined number of rows of light receiving areas; and

- j. each light receiving area in each of said columns of areas corresponding, respectively, with a light emitting element in each of said columns of elements and with one, or more, light emitting end in each of said columns of ends, and each light receiving area in each of said rows of areas corresponding, respectively, with a light emitting element in each of said rows of elements and with one, or more, light emitting ends in each of said rows of ends.

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- 2. The invention as set forth in claim 1 additionally including
- k. a plurality of said character-segment establishing means supported side-by-side for presenting a line array of independently formed message character presentations.
- 3. The invention as set forth in claim 2 additionally including
 - 1. a record medium; and
 - m. means for supporting said medium adjacent the second surfaces of said plurality of character-segment establishing means so as to provide a recordation of said message character presentations.