Feb. 1, 1966 T. V. RYCHLEWSKI 3,233,247

ELECTROLUMINESCENT PHOTOGRAPHIC REPRODUCTION DEVICE

Filed Aug. 28, 1963 3 Sheets-Sheet 1

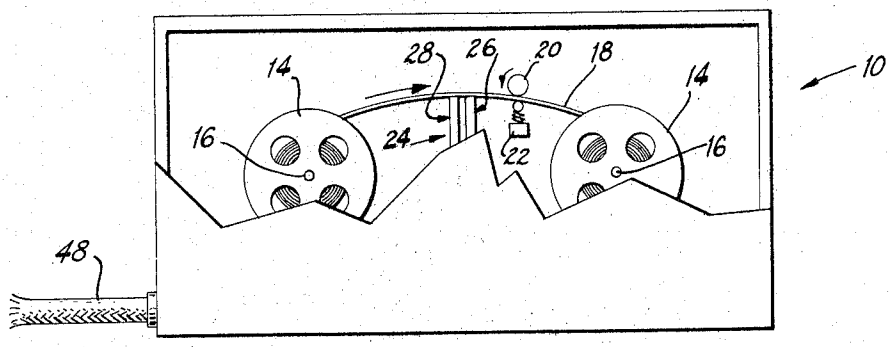


Fig. 1

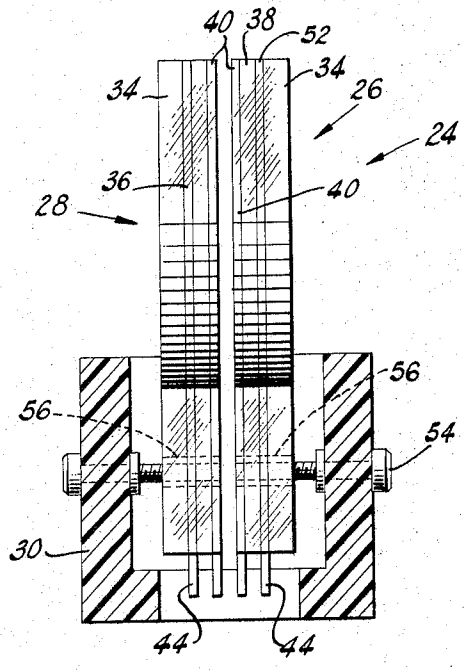


Fig. 2

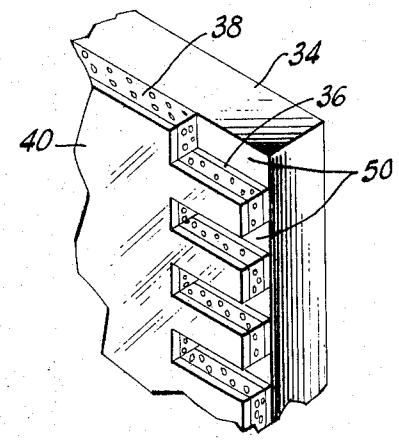


Fig. 5

INVENTOR
Thaddeus V. Rychlewski
BY
Robert C. Strausser
ATTORNEY

ELECTROLUMINESCENT PHOTOGRAPHIC REPRODUCTION DEVICE

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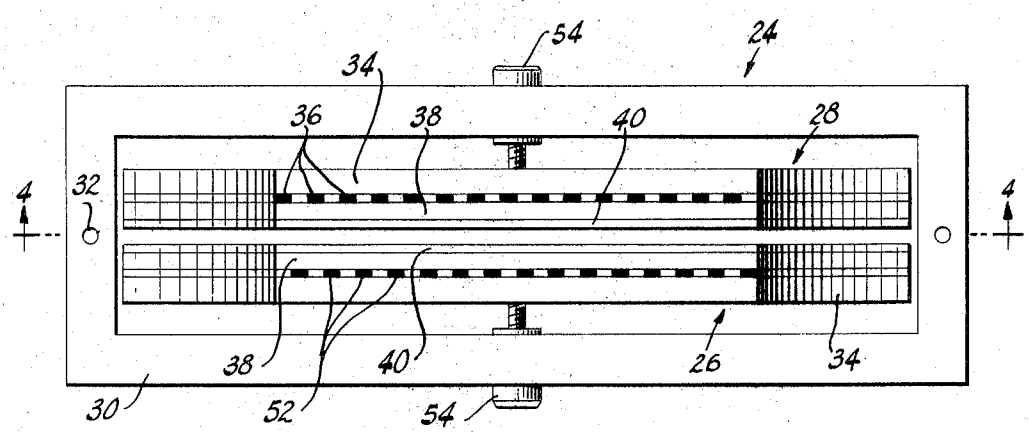


Fig. 3

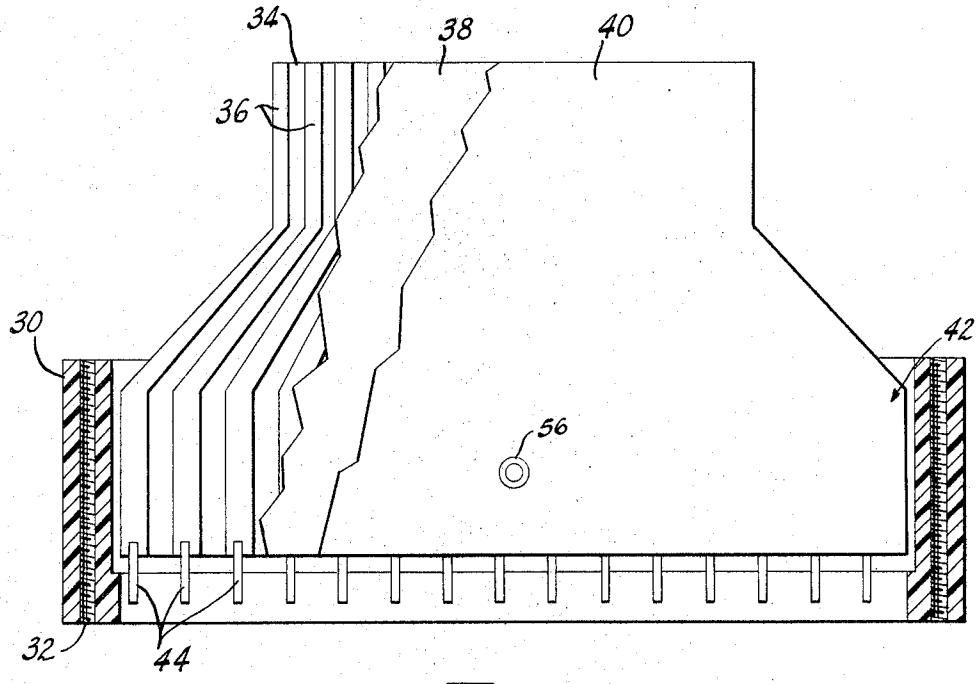


Fig. 4

INVENTOR
Thaddeus V. Rychlewski
BY
Robert E. Strauss
ATTORNEY

Feb. 1, 1966 T. V. RYCHLEWSKI 3,233,247

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Fig. 6

INVENTOR
Thaddeus V. Rychlewski
BY
Robert E. Strauss
ATTORNEY

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ELECTROLUMINESCENT PHOTOGRAPHIC REPRODUCTION DEVICE

Thaddeus V. Rychlewski, Seneca Falls, N.Y., assignor to Sylvania Electric Products Inc., a corporation of Delaware

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4 Claims. (Cl. 346—107)

This invention relates to apparatus for converting electrical signals into photographic images, wherein the signals are applied to an electroluminescent material and the images are created on a moving photosensitized tape by exposure to the electroluminescence.

A specific object of the invention is to provide for synthesizing intelligence information on a photographic tape, the intelligence being transported by wire to an electroluminescent device.

Further objects of the invention are to provide for high resolution of the formed image on the tape by causing the luminescence to appear in very small areas on the edge of an electroluminescent plate and to provide for an appropriate width of line making up the image.

Other objects will become apparent after a consideration of the following specifications when taken in conjunction with the accompanying drawing in which:

FIG. 1 is a front view of a light box, part being broken away to expose mechanism therein;

FIG. 2 is a sectional view of an electroluminescent transducer within the box;

FIG. 3 is a top view looking down on the transducer of FIG. 2;

FIG. 4 is a section on the line 4—4 of FIG. 3;

FIG. 5 is a detail view of a portion of electroluminescent transducer; and

FIG. 6 illustrates the formation of a letter T on the photographic tape.

Now referring to the drawing in greater detail, at **10** is a light tight casing provided with a light tight cover housing a pair of reels **14** mounted on shafts **16**, each of which may be driven by a torque motor (not shown) on its shaft to maintain the photographically sensitized tape **18** taut between the reels, as is conventional in tape transport mechanism. To advance the tape to the right, FIG. 1, a conventional drive in the form of a motor driven capstan **20** and spring pressed idler **22** are employed. To avoid contact with the photographic emulsion on the tape which is on the underside thereof, the idler may be a short roller engaging the underside of the tape along the edge only thereof, and a similar roller may be opposed to the capstan at the other longitudinal edge of the tape. The tape is carried over the transducer generically indicated in FIGS. 1 and 2 as **24**, this transducer forming an image on the tape as will be described. The tape wound up on the right-hand reel **14**, after exposure to the transducer, may be removed from the casing and processed in the usual fashion.

The transducer is comprised of two plates or laminates **26** and **28**, and a mounting block **30** therefor. The mounting block may be secured within the casing **10** by screws (not shown) passing through the bottom of the casing and into threaded openings **32** in the bottom of the block. Plate **26** is a laminate comprised of an opaque insulation substrate or backing member, as black glass indicated at **34** on which is printed or otherwise positioned stripes of conductive material **36**, as gold. The stripes may be .001" thick. On this striped surface there is deposited a thin coating of an electroluminescent phosphor frit **38**. Superimposed on the surface of the posphor frit is a conduction film **40**, as of evaporated on aluminum, to form an electrode common to all of the stripes **36**. The stripes, electroluminescent phosphor frit

and common electrode cooperate to form a plurality of selectively illuminable lamps. When any stripe is energized, it, in conjunction with the aluminum coating, will cause the intervening electroluminescent material to luminesce to a degree proportional to the voltage applied to the electrodes. The stripes are very thin and for reasons which will soon be made apparent are about .005" long and are spaced an equal length apart along the extent of the upper edge of the laminate **26**. The thickness of the luminescent frit coating is about .003". Thus, the luminescent area adjacent each stripe on the edge of the laminate is about 3 by 5 mils. Since only the area adjacent the upper edge of the laminate is the useful area for forming images on the tape or film, the electroluminescent material need not extend far down on the laminate. This is also true of the conductive coating **40**. Obviously an electrical lead-in is provided for the coating. Since practical difficulties offer themselves to make independent lead-in connections to the stripes **36** which at the edge are only 5 mils long, the base of the laminate is spread out, as shown at **42** in FIG. 4 and the stripes **36** are fanned out and widened to allow for connection of connectors **44** to stripes **36**, brazed or otherwise electrically secured to the stripes. Mating connectors are on the ends of wires in a cable **48** leading to the signal voltage sources.

If it be desired to provide for sharp rectangles of illumination at the edge of the laminate, the phosphor frit at the upper edge of the laminate in the spaces between the stripes may be gouged out between the stripes, as indicated at **50** in FIG. 5 and extending from the black glass to the surface otherwise bearing the aluminum electrode, leaving only rectangles of luminescent phosphor frit at the upper edge of the laminate. Such gouged out edge may be made by any known process as by sand blasting, electrolytic etching, mechanical cutting or ultrasonic drilling. To further increase the sharpness of image, all the walls of the gouged out area may be coated with an opaque black substance, as Krylon Black.

The laminate **26** just described, and the second laminate **28** form the core of the inventive device. The second laminate is constructed in the same fashion as laminate **26**, except that the stripes **52** therein are staggered with respect to the stripes **36**. The two laminates are mounted in the mounting block in adjustably spaced relation by means of screws **54** rotatably mounted in the mounting block but held against longitudinal movement therein and threaded into a collet or sleeve **56** fixedly mounted in the laminate. By rotating the screws the spacing between the plates may be varied for reasons which will be set forth. Other means, such as mica shims, may be utilized to effect the spacing and positioning of the laminates in the block.

The above described device can be used to reproduce any desired image on the film. Assume, for example, that the cable **48** has wires connected to pick up signals representing alphabetic characters and that the characters would be 150 mils high with a horizontal spacing of 83 mils (12 characters to the inch) with the figures formed by a body width of about 10 mils. This being so, to obtain the height of a character, there would be required thirty of the electroluminescent rectangles of .005" length, 15 on one laminate and 15 on the second laminate. To obtain the required width of 10 mils, for example to form the horizontal bar on the letter T, two pulsed adjacent rectangles would be required.

To give a concrete explanation of the operation of the device, consider FIG. 6 disclosing the formation of the letter T, utilizing an 8 mm. film having a film speed or sensitivity of 140 ASA and with the film moving past the head at a transport speed of 6" per second. It will

be found that when a 10 kc. signal is selectively applied to the stripes **36** and **52** and aluminum electrodes **40**, and with appropriate spacing between the plates, the letter will have high resolution.

In forming the letter on the film, because the film is in motion, the pulses on the stripes **36** in the trailing laminate **26** should be one half cycle behind the pulses on the stripes **52** in laminate **28**. Of the 10 kc., and with the 140 speed film, 5 cycles are sufficient to activate a rectangular bit. This therefore means that the bit rate is 2000 per sec. Since each bit is .003" wide, the number of bits per pitch distance of .083" is almost 28. Since there are 2000 bits per sec. and the film transport speed is .083" divided by 28, the product is almost 6 inches, a usable transport speed. Obviously with a faster sensitivity of film, an appropriate spacing of two laminates, the film transport speed can be increased. Now again consider FIG. 6. The first signal lights only one 3 x 5 mil rectangle in laminate **28** as shown at *a* in the figure. One half signal time later this signal activates the first rectangle in laminate **26**, this rectangle being displaced downwardly of the first rectangle and together with the first rectangle giving a horizontal bar thickness of the requisite 10 mils as shown at *b*. Next, a half cycle later, the first rectangle is again illuminated as at *c* and so on as indicated in views *d*, *e*, *f*, *g* and *h*. When the rectangles of electroluminescent material referred to above have been energized a sufficient number of times, all of the rectangles on one laminate **28** and then a half cycle later all of the rectangles on the laminate **26** are excited as shown at *i*. This excitation of all of the rectangles continues as indicated at *j* until the vertical leg is as thick as desired. To finish the T only the first two rectangles need be energized.

While there has been shown and described what is at present considered the preferred embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention as defined by the appended claims.

What is claimed is:

1. In an electroluminescent photographic reproduction device, the subcombination comprising: means formed to sequentially build up an intelligence conveying character on a moving, unexposed photographic film, said means comprising: a transducer having an insulating substrate, spaced conductive stripes on said substrate terminating at an edge of said substrate, a layer of electroluminescent material on said stripes and a conductive film covering said material whereby a plurality of selectively illuminable electroluminescent lamps is formed; and means for feeding said unexposed photographic film over said lamps.

2. In an electroluminescent photographic reproduction device, the subcombination comprising: means formed to sequentially build up an intelligence conveying character on a moving, unexposed photographic film, said means comprising: a transducer having an insulating substrate, spaced conductive stripes on said substrate terminating at an edge of said substrate, said stripes being fanned out to facilitate making electrical connections thereto at the end of the substrate opposite said edge, a layer of electroluminescent material on said stripes and a conductive film covering said material whereby a plurality of selectively illuminable electroluminescent lamps is formed; and means for feeding said unexposed photographic film over said lamps.

3. In an electroluminescent photographic reproduction device, the subcombination comprising: means formed to sequentially build up an intelligence conveying character on a moving, unexposed photographic film, said means comprising: a transducer having two parallelly spaced apart laminates each comprised of an insulating substrate, spaced conductive stripes on said substrate terminating at an edge thereof, an electroluminescent material over said stripes and a conductive film covering said material whereby a plurality of selectively illuminable electroluminescent lamps is formed, said laminates being positioned so that the conductive films face each other and said stripes in one laminate at one edge are staggered with respect to the stripes at the edge in the other laminate; means for feeding said unexposed photographic film over said lamps; and conductors to feed signals to said stripes.

4. In an electroluminescent photographic reproduction device, the subcombination comprising: means formed to sequentially build up an intelligence conveying character on a moving, unexposed photographic film, said means comprising: a transducer having two parallelly spaced apart laminates each comprised of an insulating substrate, spaced conductive stripes on said substrate terminating at an edge thereof, an electroluminescent material over said stripes and a conductive film covering said material whereby a plurality of selectively illuminable electroluminescent lamps is formed, said laminates being positioned so that the conductive films face each other and said stripes in one laminate at one edge are staggered wtih respect to the stripes at the edge in the other laminate; means for adjustably spacing the laminates with respect to one another; means for feeding said unexposed photographic film over said lamps; and conductors to said feed signals to said stripes.

References Cited by the Examiner

UNITED STATES PATENTS

2,885,560	5/1959	Destriau	313—108 X
2,909,973	10/1959	Koelsch et al.	
2,932,770	4/1960	Livingston	313—108 X
3,027,219	3/1962	Bradley	346—110
3,041,491	6/1962	Cistola	313—108 X
3,109,065	10/1963	McNaney	178—30

LEO SMILOW, *Primary Examiner.*

LEYLAND M. MARTIN, *Examiner.*