Nov. 26, 1968 J. GAYNOR 3,413,117

COLOR ELECTROPHOTOGRAPHY EMPLOYING A THREE COLOR FILTER AND THERMOPLASTIC MATERIALS

Filed July 16, 1965 2 Sheets-Sheet 1

Fig. 1.

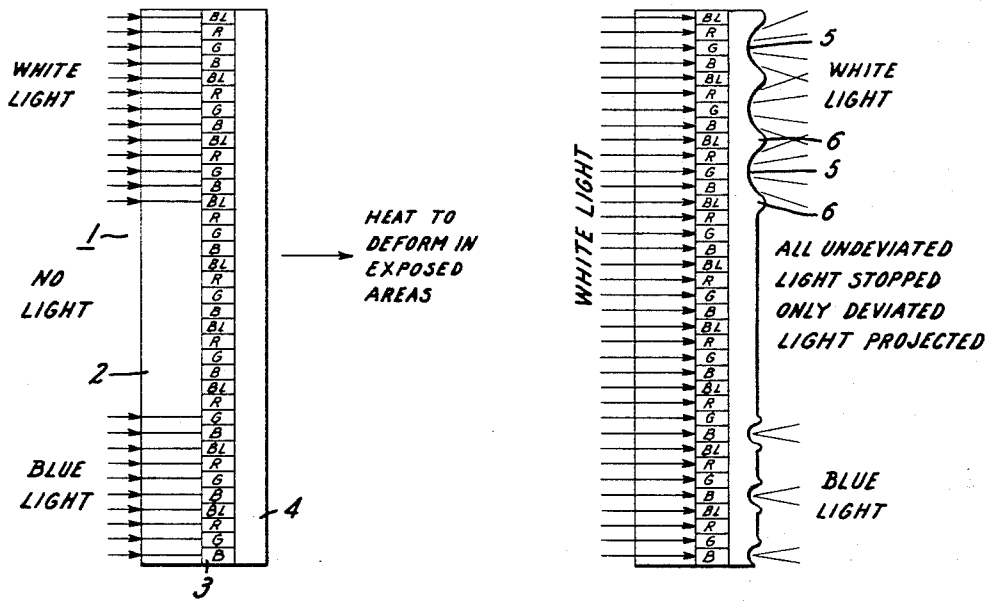
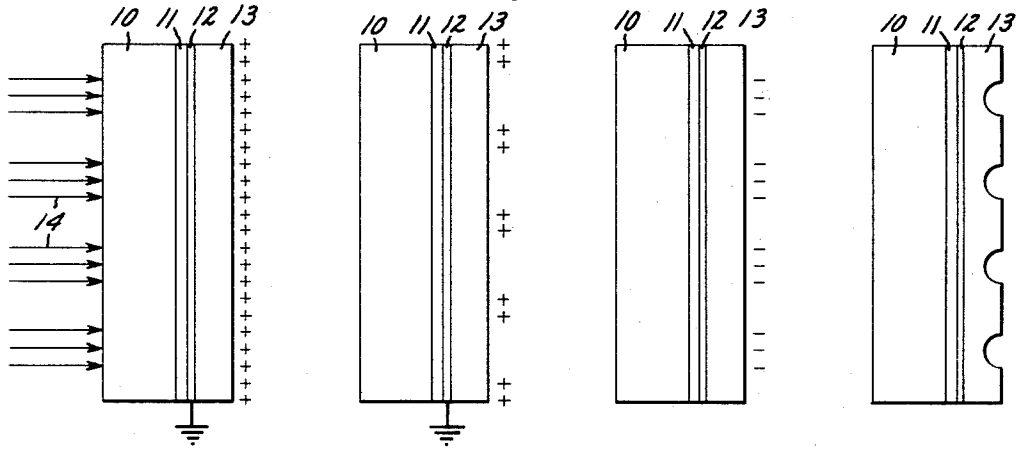


Fig. 2.



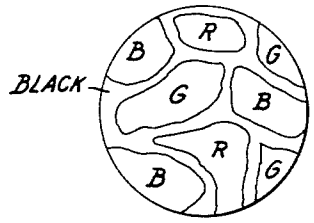


Fig. 4.

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COLOR ELECTROPHOTOGRAPHY EMPLOYING A THREE COLOR FILTER AND THERMOPLASTIC MATERIALS
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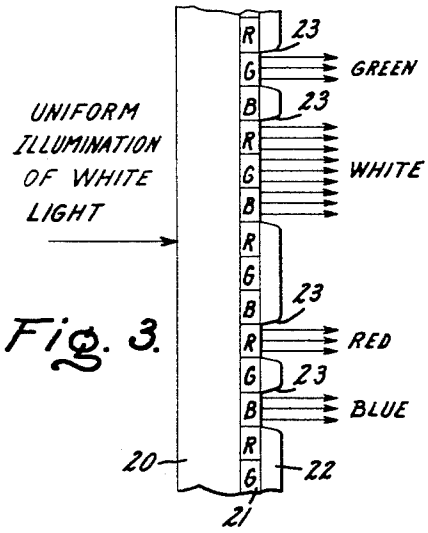


Fig. 3.

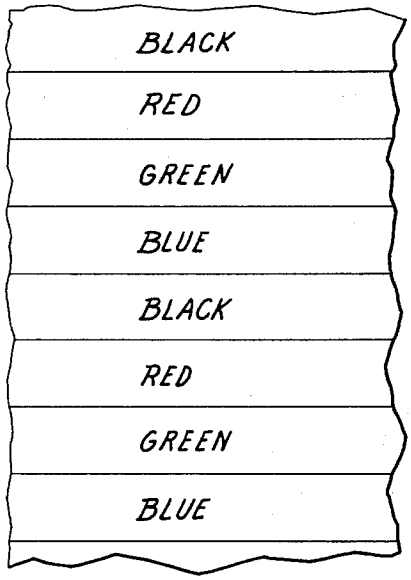


Fig. 5.

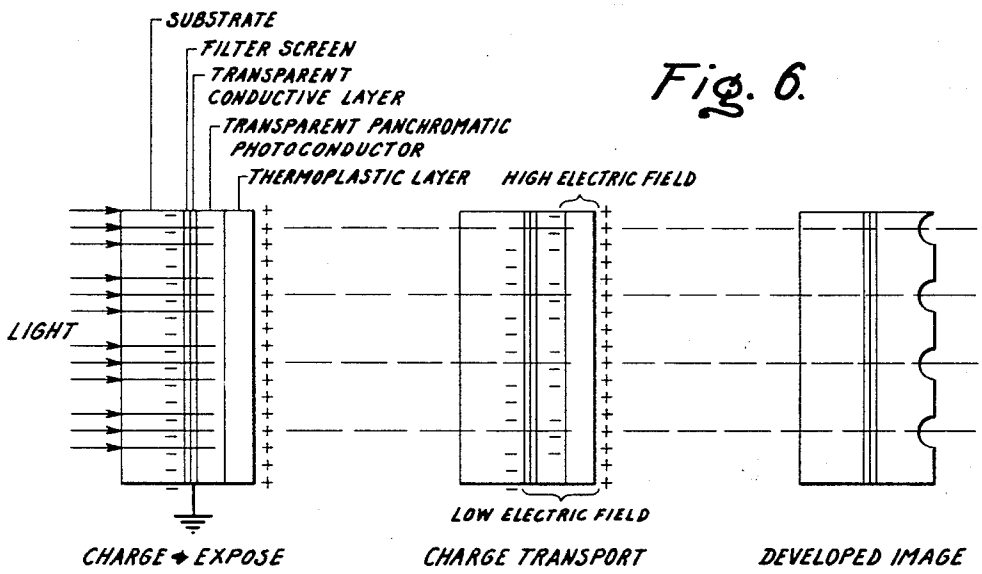


Fig. 6.

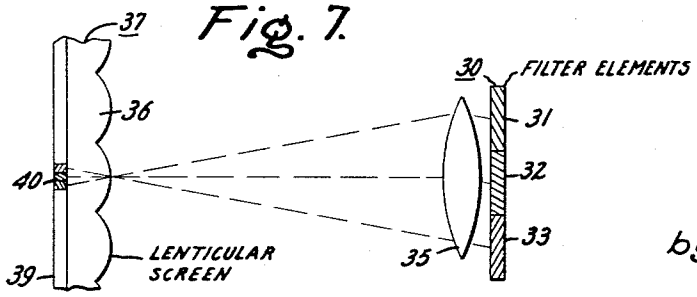


Fig. 7.

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3,413,117

COLOR ELECTROPHOTOGRAPHY EMPLOYING A THREE COLOR FILTER AND THERMOPLASTIC MATERIALS

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Filed July 16, 1965, Ser. No. 472,581
20 Claims. (Cl. 96—1.2)

ABSTRACT OF THE DISCLOSURE

A method of recording an image pattern of colored light is disclosed. The light pattern is projected through a filter composed of three primary colors onto a photosensitive thermoplastic material. The thermoplastic material is then heated to form deformations in the surface corresponding to the original color pattern.

This invention relates to the production of photographic images in color and more particularly to the production of such images by the thermal development of minute deformations in the surface of a synthetic polymeric material in a pattern which has a point-to-point correspondence to a color image previously projected upon said polymeric material with respect to light intensity as well as color.

The production of black and white photographic images utilizing the photoplastic recording technique, referred to hereinafter as "PPR," and the photocharge recording technique, referred to hereinafter as "PCR" are known and are more fully described respectively in U.S. patent applications, Ser. No. 79,260, filed on Dec. 29, 1960 in the name of Joseph Gaynor, entitled "Information Storage on Deformable Medium," now U.S. Patent 3,291,601, granted Dec. 13, 1966 and Ser. No. 231,138, filed on Oct. 17, 1962 in the names of Joseph Gaynor and Gordon J. Sewell, entitled "Information Recording," now abandoned in favor of continuation-in-part application Ser. No. 517,315, filed Dec. 29, 1965, both applications being assigned to the assignee of the present invention.

Briefly, PPR involves the use of a recording medium comprising a thin film of a dielectric photoconductive thermoplastic polymeric material supported upon an electrically conductive layer which in turn is usually carried by a supporting member. A uniform electrostatic charge is applied to the thermoplastic photoconductive film and the film exposed to a pattern of incident light. In those areas which are illuminated, the electrical resistance of the photoconductive polymer markedly decreases to a degree which is proportional to the intensity of the incident light, permitting the electrostatic charges associated with those areas to leak off into the electrically conductive ground plane layer, thereby creating a remanent charge pattern having a point-to-point correspondence with the incident light pattern. When the thermoplastic layer is heated to its softening point, the residual charge pattern causes the surface of the plastic to deform in a pattern of minute surface deformations in the form of ripples or grooves which have the same point-to-point correspondence referred to previously. After this image pattern is produced, the plastic layer is cooled to below its softening point to "freeze" the deformation pattern in place.

In the PCR process, a dielectric thermoplastic film is supported by a substrate. The thermoplastic film contains a photoionizable substance such as, for example, iodoform, and which upon being exposed to a light pattern spontaneously develops a stress pattern in the thermoplastic film which has a point-to-point correspondence

with the light pattern and when the film is subsequently heated to its softening point, forms a ripple pattern of surface deformations similar to those formed in the PPR process. These ripples are then "frozen" in place to form a rigid ripple pattern having a point-to-point correspondence to the light pattern.

In both the PPR and PCR processes, the image pattern of surface deformations in the recording layer may be retrieved or "read out" utilizing visible light and a schlieren optical system. Where it is desired to project light through the recording medium, all the layers of the laminated recording member must be transparent. Those areas of the recording medium surface which do not bear deformations will permit the light to pass through and continue on an undeviated path whereas the light which passes through areas which have surface deformations will emerge on paths which follow directions which deviate from the original direction. Using a schlieren optical projection system, the undeviated light is completely blocked out while the deviated light passes through to form a projected image which may be viewed upon a screen. A more complete description of a schlieren optical readout system suitable for retrieving the information stored as deformations on the surface of a transparent recording member may be found in a copending application of W. E. Glenn, Ser. No. 8,842, filed Feb. 15, 1960, entitled "Method and Apparatus and Medium for Recording," now Patent No. 3,147,062, granted Sept. 1, 1964, and assigned to the assignee of the present invention.

While satisfactory recordings have been provided by the previously described processes, they have been limited to the projection of black and white type images alone. It would, therefore, constitute a general advance in the entire field of information and image recording if a polychromatic image could be projected which would bear a true color relationship to the original.

It is, therefore, a principal object of this invention to provide a recording medium capable of storing a polychromatic image pattern of light in the form of minute surface deformations which image pattern may be recoverable as a projected image having a point-to-point correspondence to the oriignal image pattern in color as well as in form.

A further object of this invention is the provision of a method for the storage and retrieval of color images.

Other objects and advantages of the invention will become apparent to those skilled in the art from the following description of the preferred embodiments of the invention taken in conjunction with the accompanying figures of the drawings in which:

FIGURE 1 is a schematic illustration of one embodiment of the invention utilizing a screen plate;

FIGURE 2 is a schematic illustration of another embodiment of the invention utilizing a screen plate;

FIGURE 3 is a schematic illustration of a still further embodiment of the invention utilizing a screen plate;

FIGURE 4 is a schematic illustration of one form of a screen plate;

FIGURE 5 is a greatly enlarged illustration of another form of a portion of a screen plate;

FIGURE 6 is a schematic illustration of another embodiment of the invention utilizing a screen plate; and

FIGURE 7 is a schematic illustration of another embodiment of the invention utilizing another form of a screen plate.

Briefly stated and in accordance with one embodiment of the invention, one surface of a transparent thermally stable substrate is provided with a filter "screen plate" coating consisting of large numbers of tiny red, green, and blue light filters over which is formed a transparent layer of a heat-deformable thermoplastic polymer material of

the type used in either the PPR or the PCR processes which have panchromatic response to light in the visible spectrum. A polychromatic image or light pattern is imposed, by projection, for example, upon the uncoated surface of the transparent substrate and is transmitted therethrough to the screen plate whereupon the color image or pattern is broken up into the primary colors by the filters and transmitted to the thermoplastic panchromatic recording layer. The light produces a stress pattern in the thermoplastic layer which has a point-to-point correspondence to both the image or pattern form, color, and intensity. The thermoplastic layer is then heated to its softening point whereupon the stress pattern causes the softened surface to deform in a pattern of minute ripples or surface deformations corresponding to the original light image pattern and the thermoplastic layer is cooled to freeze the deformations in place. When the uncoated substrate surface is exposed to a uniform beam of white light, the light transmitted through the screen plate and the deformed plastic layer may be projected through a schlieren optical system to form an image having the form and color of the original image or pattern.

More specifically, and with particular reference to the several figures of the drawing, FIGURE 1 illustrates how the invention may be applied to the PCR process. As shown schematically, the recording member **1** is composed of a substrate **2**, such as glass for example, which is transparent to light in the visible spectrum, a filter screen plate **3** which is composed of red, green, and blue light transmission filter elements identified by the letters R, G, and B, respectively, and opaque or black portions identified as BL. Overlying and in physical contact with screen plate **3** is a layer **4** of a transparent panchromatic thermoplastic polymeric material, such as for example, commercially available polystyrene resin having a molecular weight of about 20,000, an electrical resistivity at room temperature of about 10^{19} ohm-centimeters and a softening temperature of about 80° C., and which contains a small amount of a photoionizable substance such as iodoform, for example. It will be appreciated of course that the relative thicknesses of screen plate **3** and layer **4** have been greatly exaggerated with respect to that of substrate **2** for purposes of illustration. The photocharge recording layer may be prepared by dissolving 5 parts by weight of iodoform in 1000 parts of a 10 percent solids solution of the previously described polymer in benzene to form a homogeneous liquid solution and overcoating the screen plate layer **3** therewith and evaporating the solvent under dark room conditions. When the recording member is exposed to a pattern of light as shown, while light passing through the red, blue, and green filter elements is broken down into the primary colors and passed to the photocharge layer as such. For example, the red filters pass only the red components, the blue filters only the blue components, and the green filters only the green components. Of course, the black or opaque elements pass no light at all. The light which is transmitted to the photocharge layer **4** reacts therewith to produce ion pairs of positively and negatively charged particles in the illuminated portions of thermoplastic materials. When heated to the softening point of the thermoplastic, the stress pattern produced by these ion pairs causes the formation of optically effective grooves in those areas which were illuminated and ridges in areas which were not illuminated but adjacent to illuminated areas or zones. These grooves **5** and ridges **6** have been exaggerated in the drawing for purposes of illustration. If instead of white light, monochromatic light such as, for example, blue light is used, light is transmitted through only the blue filter elements to the photocharge layer and, necessarily only those areas which are illuminated by light transmitted by the blue filters are activated and subsequently are thermally deformed, as shown. If collimated white light is then projected through the substrate **2**, the screen plate **3** and the thermally deformed plastic layer **4** and observed by means of a schlieren optical system, all undeviated light is stopped by the bar system while all the deviated light is permitted to pass. In the case illustrated in FIGURE 1, since white light is composed of approximately equal amounts of red, green, and blue light, the total amount of energy as red, green, and blue light transmitted by any given group of red, green, and blue filters to the photocharge layer is directly proportional to the total amount of energy as white light which was received by that group of filters. Since the degree of stress produced in any given area in the photoionizable layer is proportional to the energy applied thereto, the depth of the grooves produced upon thermal development and hence the ability of the deformation to produce light scattering is directly related to the intensity of the incident light on any given area during the formation of the stress pattern and its subsequent development. Furthermore, if the polychromatic incident light has a greater amount of red, for example, than blue and green components, the resulting grooves will be deeper adjacent the red filter elements and hence, upon projection, red light passed by the red filter will be scattered to a greater degree by a given groove than the blue and green light passed by adjacent filter elements and thereby the projected schlieren image color will retain the same shade of color as the original image. It should be noted here that the black or opaque elements interposed between the primary color groups of filter elements are used to break up or differentiate the image pattern and serves the same function as a screen mesh or a grating, for example, as is well known in the art.

The application of the invention to the PPR process is illustrated in FIGURE 2 wherein one surface of a thermally stable transparent substrate **10** is provided with a filter screen plate **11** which is similar to screen plate **3** and which is overcoated by an optically transparent electrically conductive layer **12**, which may be a vapor deposited film of tin oxide, for example. The thermoplastic photoconductive recording layer **13** may be composed of a layer of the same polystyrene resin as previously recited but substituting a dispersion of a photoconductive material such as copper doped cadmium sulfide or cadmium selenide, for example, for the photoionizable material and applied to the color screen as previously set forth. As illustrated, the outer surface of the recording layer **13** is electrostatically charged positively in a uniform manner by means of a corona discharge, for example. The conductive layer **12** is grounded and a pattern of polychromatic light shown by the arrows **14** is caused to impinge upon the uncoated surface of the substrate **10** as shown. The light pattern is transmitted through the screen plate **11** and is broken up thereby into a pattern composed of the primary color components by the screen plate. After passing through the screen plate, the primary color components of the light pattern react with the photoconductive thermoplastic layer **13** to reduce the electrical resistance of illuminated portions thereof so that surface charges associated with those portions are permitted to leak off through the conductive coating **12** leaving a remanent pattern of positive charges, corresponding to areas which had not been illuminated, as shown. As will be apparent, if the thermoplastic layer were thermally developed at this point, a negative or reverse deformation pattern would result. Therefore, the surface is electrostatically charged negatively in a uniform manner similar to the first or initial charge. This causes charge neutralization in those areas which bore the remanent positive charges and results in the deposition of negative charges in those areas which had been illuminated. Now, when the recording layer is thermally developed, the ripple or groove pattern is produced in those areas which had been illuminated. It will be understood that while as a matter of convenience and for purposes of illustration, complete leakage of the initial charge pattern in areas of illumination has been shown, this does not actually take place, but rather a modulated remanent charge pattern exists. Thus, the reverse polarity charging step re-

sults in a modulated pattern of charges in those areas which had been partially discharged by illumination. In this way, a positive deformation pattern may be produced which contains all of the details of form and color of the impressed light image and which may then be projected by a schlieren optical system in the same manner as previously described.

It should be noted at this point that by proper selection of such factors as for example the level of electrostatic charge, intensity of illumination, length of time of exposure, and thickness of the thermoplastic photoconductive film, the physical depth of the grooves formed upon thermal development can be made to extend completely through to the substrate, i.e., to the surface of the filter screen plate. This condition is illustrated in FIGURE 3 in which a transparent substrate **20** supports a filter screen plate **21** and a thermally deformed recording layer **22**. It will be noted that, as pointed out previously, grooves **23** may extend completely through the recording layer **22** to the filter screen plate **21**. If the thermally deformable recording layer is made from a material which is not completely transparent, such as for example, by adding an opaque dye to the previously described resin, and if the initial, undeformed thickness of the recording layer is such that at the light intensity used to project the recorded image, undeformed areas are opaque, but any lessening of the thickness by grooving begins to pass light, then when white light is projected through the recording member, a color image is projected through the recording layer which may be directly viewed without the use of a schlieren optical system.

It will, of course, be appreciated that the depth of grooves formed in the recording layer will be proportional to the intensity of light from the original image pattern in any given area and that the amount of light passed through the resin layer at the bottom of such grooves will be similarly proportional to the thickness of the resin up to the limiting condition where the groove or deformation extends to the filter screen. Thus, modulation of intensity may be achieved.

Filter screen plates useful in the practice of the invention may be made in a number of ways. For example, dyed starch grains about 0.015 mm. in diameter may be utilized in the following manner. Equal volumes of the starch grains may be dyed red, green, and blue and thoroughly mixed to form a uniformly gray powder. A clear glass plate may then be coated with a clear adhesive such as varnish or the like and when tacky, a layer of the starch grains applied thereto by dusting the mixture on the tacky surface. The excess starch is removed and the adherent starch grains flattened out by a pressing operation forming a filter screen having the appearance under appropriate magnification of FIGURE 4. The interstices may then be filled by rubbing finely divided graphite or carbon black over the surface of the filter screen plate and after the adhesive has set, removing any residual carbon from the surfaces of the filter screen plate elements. If desired, colloidal resin particles may be substituted for the starch particles. In general, the element widths should be about 0.0005 inch to about 0.001 inch in width and the interstices, if they exist, should be filled with a strongly absorbent material. The relative areas of the primary colors should be such that under the viewing light with which the screen is to be used, the overall appearance is a neutral gray.

While the foregoing method of producing a filter screen plate results in a more or less statistically random distribution of the three colors of filter elements over the surface of the transparent substrate, a regular pattern of the elements may be achieved by a number of methods. For example, strips or sheets of red, green, and blue colored transparent plastic about 0.0005 to about 0.004 inch thick may be laminated together using any appropriate adhesive. An appropriate number of such three-layer laminae may then be laminated together with adhesive with a 0.0005 to about 0.004 inch thick sheet of opaque or black plastic between each laminated layer to form a composite body as shown in FIGURE 5. If a thin sheet is then cut from this composite body in a plane perpendicular to the planes constituting the interfaces of the laminae, a filter screen corresponding to that illustrated by FIGURE 1 is obtained. This may then be cemented to one surface of the transparent substrate **2** and a layer or film of the recording thermoplastic material formed thereover as previously described.

Alternatively, the composite body may be made using only three primary color transparent sheets in recurring series and employing relatively heavy layers of a black or opaque adhesive between each layer, thereby omitting the black or opaque sheet materials, and slicing a thin layer filter screen therefrom as above. If desired, a plurality of such slices may be cut from such a composite body and laminated together using relatively heavy layers of black adhesive, taking care to avoid having matching color zones in adjacent layers, i.e., red opposite red, for example. This composite body may then be sliced in a plane perpendicular to the plane of lamination or the interfaces between the layers to form filter screens in which each color filter element is in the form of a minute rectangular or square, each filter element being separated from each other adjacent filter element by a black or opaque zone which black zones form a screen-like grid useful for sampling or discrimination of the image, as previously referred to.

Other ways of making a filter screen will occur to those skilled in the art, such as, for example, by mechanical printing techniques, wherein colored inks may be directly ruled on the substrate surface, or by conventional photographic techniques. The shape of the color transmitting areas may take any appropriate form and is not restricted to squares or rectangles.

While in all the foregoing, the invention has been described in connection with the use of a single recording layer of a thermoplastic material in direct contact with the filter screen, it is equally applicable to the so-called "two-layer" PPR technique. This is best illustrated in FIGURE 6 wherein one major surface of a transparent substrate is provided with a filter screen plate similar to those previously disclosed. A transparent electrically conductive layer overlies the filter screen plate and is in electrical contact with a transparent panchromatic photoconductive layer which in turn is in intimate contact with a thermoplastic polymeric layer, all as shown. The outer surface of the thermoplastic layer, which may be composed solely of a polystyrene resin as previously described, is uniformly electrostatically charged by, for example, a corona discharge. For convenience, this has been schematically illustrated as a series of plus signs adjacent the outer surface of the thermoplastic layer. A corresponding uniform charge of opposite sign is induced adjacent to the conductive layer and is schematically shown by the negative signs. The conductive layer is grounded and a pattern of polychromatic light is projected or otherwise caused to be impinged upon the surface of the transparent substrate opposite to the recording member. In those areas where the light transmitted through the substrate and through the conductive layer impinges upon the filter screen plate, it is broken up into the primary colors as previously described and reacts with the photoconductive layer to provide a relatively conductive path through the photoconductor. As a consequence, negative charges in those areas migrate to the photoconductor-thermoplastic interface, as shown, while the negative charges associated with areas or zones which were not illuminated remain in their original locations. The electric field between the negative charges which were not allowed to move and the postive surface charges is significantly smaller than the field between the negative charges which have migrated to the photoconductor-thermoplastic interface and the surface positive charges.

Consequently, when the thermoplastic layer is heated to its softening point, those areas which correspond to the areas of the image pattern which were lighted will deform at the expense of those which were not so lighted, and also those areas which were exposed to a higher intensity of light energy will deform to a greater extent than those exposed to a lesser light intensity. As before, upon schlieren projection, a fully modulated image will be observed having a point-to-point correspondence with the original image both with regard to form, shade, and color.

All the foregoing examples of the invention have involved the use of a laminated structure in which the filter screen plate has formed an integral, permanently affixed part of the recording member. It should be appreciated that by so doing, registration problems are eliminated, however, it should also be appreciated that the recording layer or layers may be made as a separable element so that the substrate and filter screen plate may be separated and not subjected to heating during thermal development of the thermoplastic recording layer. After development, the substrate and filter screen plate may be reassembled with the developed recording layer, however, proper registration may require some trial and error adjustments before a perfect image is achieved.

A yet further embodiment of this invention entails the use of what may be termed an "optical filter screen plate." This is illustrated in FIGURE 7 in which a banded filter **30** composed of a red band **31**, a green band **32**, and a blue band **33** is positioned as shown with respect to any suitable optical lens system **35**. The lens system focuses polychromatic light which has been broken up into the three primary colors by the banded filter **30** onto the lens-like surfaces **36** of a recording member **37**. Recording member **37** is composed of a lenticular supporting screen member **38** made of a transparent, relatively thermally stable material such as for example, "Mylar," a polyethylene terephthalate resin marketed by E. I. du Pont de Nemours, Inc., which is provided on its free surface with cylindrical lens-like deformations **36** as shown. These deformations extend across the width of the support member and may be of the order of 600 per linear inch and extend out of a plane determined by the bottoms of the "trough-like" intersections of the curved surfaces of the lens-like deformations. Such transparent film is marketed under the trade name of "Kinescope" by the Eastman Kodak Company. On the opposite surface of member **38** is a thermoplastically deformable recording layer **39** of either the PPR or the PCR type. When an image pattern of polychromatic light passes through the banded filter **30**, the image pattern is broken up into the three primary colors and is focused by the lens system **35** upon the individual lens-like embossings **36** which are contoured to focus the light received thereon as very small images of the banded filter **30** on the recording layer **39** under each of the embossings, as shown at **40**. As the light reaching each section comes from a single area of the image pattern, separate records of the red, blue, and green components of the image pattern are obtained. The light incident upon each area under each lens-like embossing **36** reacts with the recording layer to provide a stress pattern having a point-to-point correspondence with the image pattern as before and may be thermally developed to form a surface pattern of grooves or ripple deformations as previously described. The deformation image pattern may then be projected through an optical system similar to that used for recording the image pattern wherein polychromatic light is passed through a banded filter such as filter **30**, through an appropriate lens system, through the developed recording member **37** and the usual schlieren optical system for viewing. Obviously, if a recording member and technique as described in connection with FIGURE 3 is employed, the schlieren optical system may be eliminated.

From all of the foregoing, it will be apparent to those skilled in the art that the subject invention provides a solution to the pre-existing problem of providing color images having a point-to-point correspondence with an image pattern which was recorded by both PPR and PCR techniques with regard to color, form, and intensity of color. It will be appreciated that if the supporting layer or the recording layer of the recording medium are composed of materials which have a slight absorption in the visible range of the spectrum, then an appropriate color balance may be achieved by suitable alterations of the color composition of the filter screen plate. In view of the many variations of the invention which will occur to those skilled in the art, it is not intended that the scope of the invention be limited to any one or all of the specific embodiments thereof which have been described for exemplary purposes but only by the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A method for recording an image pattern of colored light comprising:

(a) projecting an image pattern of colored light through a filter composed of areas of three primary colors to produce an image pattern composed of small areas of primary colored light;

(b) causing the image pattern of primary colored light areas to impinge upon a film of a transparent, photosensitive thermoplastic material to produce a pattern of stresses therein having a point-to-point correspondence to the pattern of primary colored light;

(c) heating said film to its softening point to permit said stresses to form deformations in the surface of said film in the form of a pattern having a point-to-point correspondence with said stress pattern; and

(d) cooling said thermoplastic film to solidify said deformation pattern.

2. The method recited in claim **1** in which said filter is composed of a plurality of areas which respectively and selectively transmit red, green, and blue colored light.

3. The method recited in claim **2** in which said filter is composed of a substantially statistically random distribution of said areas.

4. The method recited in claim **3** in which each of said areas has an average transverse dimension of less than about 0.002 inch and interstices between adjoining areas are filled with a strongly absorbent material.

5. The method recited in claim **2** in which each of said areas comprises elongated rectangular elements each less than about 0.005 inch in width.

6. The method recited in claim **5** in which said areas are regularly arrayed in repeating groups of the three color transmissive elements substantially each group containing the same three elements arranged in the same order and each group of three separated from the adjacent groups by an elongated rectangular opaque element, each such opaque element having approximately the same width as one of said color transmissive elements.

7. The method recited in claim **2** in which each of said areas comprises a substantially geometrically regular shape which is substantially identical in configuration to each other such area and having a maximum transverse dimension of about 0.005 inch.

8. The method recited in claim **7** in which each of said areas is separated from adjoining areas by a band of an absorptive material whose width does not exceed about 0.005 inch.

9. The method recited in claim **1** in which said image pattern of colored light is sequentially projected through a filter consisting of three approximately equal areas which respectively and selectively transmit red, green, and blue light and through a transparent member having a surface upon which the filtered image impinges consisting of a plurality of minute lenses to produce said image pattern composed of small areas of primary colored light.

10. A method for reproducing the image pattern of colored light recorded in claim **1** comprising projecting

a uniform beam of white light through said filter and said deformed thermoplastic film to produce a projected image pattern corresponding to said originally projected image of colored light.

11. A color recording medium comprising in combination a transparent thermally stable support member having a pair of substantially parallel planar major surfaces, a recording film supported by one of said surfaces composed of a thermoplastic transparent material having a softening temperature substantially lower than said support and which, when exposed to an image pattern of light develops a pattern of stresses therein having a point-to-point correspondence with said image pattern, and means to cause an image pattern of colored light to be impinged upon the surface of said recording film adjacent to said support member in the form of minute areas of primary color for each elemental area of the image pattern of colored light.

12. A color recording medium as recited in claim **11** in which said means includes a transparent filter layer positioned adjacent one of said major surfaces of said support member, said filter layer being composed of a plurality of areas which respectively and selectively transmit red, green, and blue colored light.

13. A color recording medium as recited in claim **12** in which said filter is composed of a substantially statistically random distribution of said areas.

14. A color recording medium as recited in claim **13** in which each of said areas has an average transverse dimension of less than about 0.002 inch and interstices between adjoining areas are filled with a strongly absorbent material.

15. A color recording medium as recited in claim **13** in which each of said areas comprises elongated rectangular elements each less than about 0.005 inch in width.

16. A color recording medium as recited in claim **15** in which said areas are regularly arranged in repeating groups of the three color transmissive elements, substantially each group containing the same three elements arranged in the same order and each group of three separated from its neighboring group by an elongated rectangular opaque element, each such opaque element having approximately the same width as one of said color transmissive elements.

17. A color recording medium as recited in claim **12** in which each of said areas comprises a substantially geometrically regular shape which is substantially identical in configuration to each other such area and having a maximum transverse dimension of about 0.005 inch.

18. A color recording medium as recited in claim **17** in which each of said areas is separated from adjoining areas by a band of an absorptive material whose width does not exceed about 0.005 inch.

19. A color recording medium as recited in claim **11** in which said means includes a transparent filter consisting of three approximately equal areas which are adapted to respectively and selectively transmit red, green, and blue light therethrough, means for focusing such transmitted light upon the other of said pair of major surfaces of said support member and said other surface being provided with a plurality of minute lenses which are adapted to produce an image pattern on said recording film in the form of small areas of primary colored light.

20. A color transparency having recorded thereupon a color image pattern suitable for projection comprising a transparent support member having a substantially planar major surface, and a transparent film supported on said surface, said film having an exposed surface bearing a pattern of minute ripples having a point-to-point correspondence to an image pattern of colored light and forming a record thereof, each ripple corresponding to a predetermined pattern of one of three primary colors of a corresponding area of the recorded colored light image pattern.

No references cited.

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