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ELECTRORESPONSIVE RECORDING BLANK

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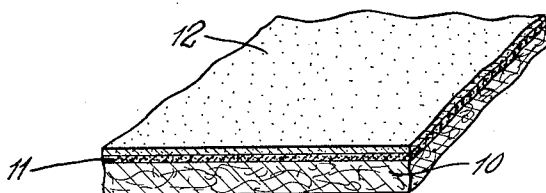


Fig. 1.

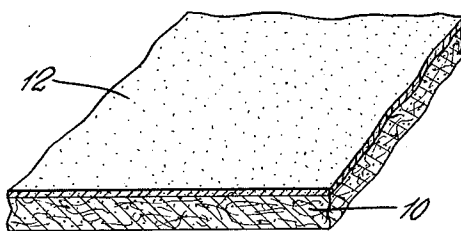


Fig. 2.

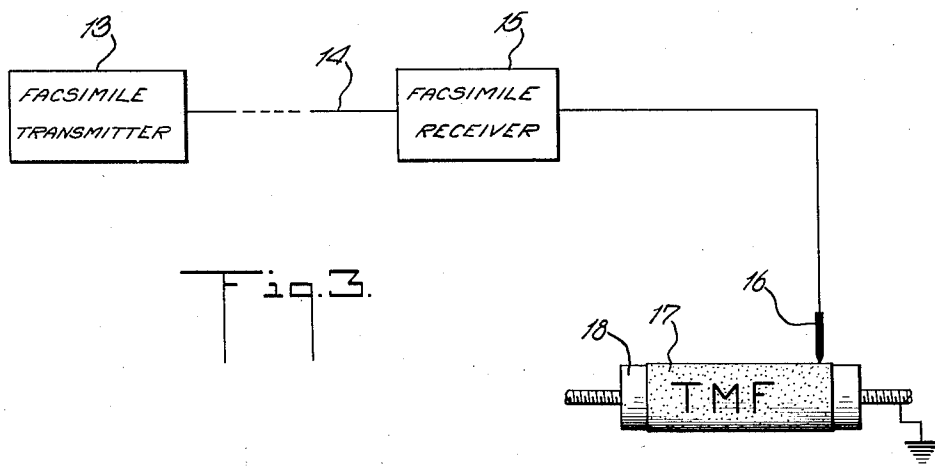


Fig. 3.

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ELECTRORESPONSIVE RECORDING BLANK

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This invention relates to electro-responsive recording blanks and with particularity it refers to blanks which respond to the action of electric currents or potentials applied thereto, such for example as telefacsimile signals and the like.

A principal object of the invention is to provide an electro-responsive recording blank which produces a greater degree of contrast between the areas acted upon by the electric signals, and the adjacent areas which are not acted upon by those signals.

Another principal object is to provide an electro-responsive recording blank which can be used directly as a matrix for photographic reproduction without requiring a separate source of light such as is ordinarily required in making contact prints from photographic transparencies.

Another object is to provide an electro-responsive recording blank which has its surface treated in such a way that when subject matter is recorded thereon, it is readable under very low levels of illumination.

A feature of the invention relates to an electro-responsive recording blank of the type which directly produces a record in response to applied electric signals, and having a masking coating of contrasting color with respect to the undersurface of the blank, the masking coating having incorporated therein a specially chosen material or mixture of materials for increasing the percent of contrast between the areas acted upon by the electric signals and the adjacent areas.

Another feature relates to an electro-responsive blank having an outer masking coating of substantially whitish hue, and having incorporated therein a luminescent material which has the property of increasing the sensitivity of response of the masking coating to applied electric signals.

Another feature relates to a facsimile recording blank of the type having a surface coating which is adapted to be removed in localized areas in response to applied electric signals, and having incorporated in the coating a pigment material constituted of from 10 to 100% of luminescent substance.

A further feature relates to a substantially whitish surface coating for record blanks in which the whitish hue is derived mainly from the presence of a luminescent or phosphorescent material or mixture of such materials.

A further feature relates to an improved record blank which is particularly well suited for use in recording electric signals such for example as telefacsimile signals and the like.

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A still further feature relates to a novel form of matrix wherein a visual representation is recorded in the form of black non-luminescent outline and wherein the space between the said outlines is in the form of luminescent material.

Other features and advantages not specifically enumerated will be apparent after a consideration of the following detailed descriptions and the appended claims.

In the drawing,

Fig. 1 is a perspective view, partly sectional, of one form of record blank according to the invention.

Fig. 2 is a modification of the blank of Fig. 1.

Fig. 3 is a schematic diagram of a telefacsimile recording system embodying a blank according to the invention.

In the following descriptions and in the appended claims, the expression "luminescent material" is used in its generic sense to include phosphors and fluorophors, and also so-called self-luminescent materials such as those that are activated by radium or a radium salt or compound. As is well-known in the art of luminescent materials a phosphor consists of a so-called matrix substance and an activating component and wherever the term phosphor is used in the appended claims it is intended to include such a material containing a matrix and an activator or phosphorogen.

In the facsimile recording art there are, in general, two types of recording blanks, namely the photographic type and the other direct recording type. The photographic blank suffers from the disadvantage that the recording machine must be operated under dark room conditions and comparatively expensive photographic developing equipment and operations are required before a complete record is obtained. The direct recording blank, on the other hand, is capable of use under normal light conditions and the record is immediately and permanently produced as the electric signals are being received. One kind of direct recording blank that has been found useful heretofore, comprises a backing or web of paper which has a white masking coating applied thereto, which coating is removable in localized areas in response to applied electric signals, so as to expose the undersurface which is usually black. In such blanks, the electrical characteristics of the blank material are of extreme importance. Thus in one known blank, the paper backing is itself rendered electrically conductive to a predetermined degree by incorporating in the paper itself a conductive material such as powdered carbon or carbon black.

In another known blank, the paper backing can be of any usual kind of paper and has its surface treated or coated with a conducting material consisting to a great extent of powdered carbon to impart the necessary blackness and conductivity. In either type of blank, the black underface is masked by the white masking coating. Since it is the masking coating which responds to the applied electric signals, in so far as its removal is concerned, and since in the telefacsimile art the recording is effected by acting on successive elemental areas, for example areas of about .01 square inch, it is clear that the electrical characteristics of this masking coating are also of great importance if satisfactory recordings are to be achieved. Heretofore, the masking coating has derived its contrasting hue with the black underface, by having incorporated in the masking coating a conventional white pigment such as titanium oxide, zinc oxide and the like, together with a binder such as a cellulose ester or ether. While such prior blanks have been found satisfactory for most uses, they have in many cases suffered from the drawback that in order to achieve the desired electric properties for the masking coating, it has been necessary to apply extremely light masking coatings which, due to their thinness, appear gray in color instead of being a true whitish hue. The result is that when the masking coating is removed by the applied electric signals, the percent contrast of the unremoved areas as compared with the black underface is not the most desirable. This relatively low contrast may render the record unreadable at very low levels of illumination.

I have found that by incorporating into this masking coating a quantity of luminescent material, not only are the recording characteristics improved, but also the finished record has a higher degree of contrast between the areas carrying the recorded intelligence and the adjacent background areas. Furthermore, since the finished record consists to a great extent of a background surface having luminescent properties, the finished record can be used as a matrix for acting directly on a photographic sensitized film so as to produce on the film for example by a contact printing process, a copy of the record without requiring the use of special exposure lamps such as are ordinarily used in photographic printing processes.

Referring to the drawing, there is shown a recording blank comprising a base or carrier 10 of paper, although other pliable materials such as fabric, photographic transparencies or the like may be employed. The paper 10 is provided with a stratified sheath comprising two strata or layers 11, 12. Layer 11 comprises for example gas black or carbon black mixed with any suitable adhesive such as gelatin, gum, starch, casein, emulsified wax, cellulose ether or ester. It is desirable to use as little binder as possible and in general the amount of binder may vary from 5 to 30% of the dry weight of the gas black. The masking layer or coating 12 consists of white pigment material in a suitable adhesive or binder. This pigment material, in accordance with the invention, includes one or more luminescent materials. The binder that is used for the coating material 12 should preferably be of a different character from the binder that is used for coating 11. In general, it is preferable to use such binders as gelatin, gum, starch, casein, emulsified wax or the like for the coating 11, and to use binders of the cellulose ester or ether type

for the coating 12, so as to prevent intermingling of the two coatings when the coating 12 is applied to the coating 11. These binders may be reversed, that is to say, the coating 11 may use a cellulose ester or ether, and the coating 12 may use a gelatin, gum, starch, casein or casein binder.

As an example of the proportion of gas black and binder that may be used in forming conductive coating 11, the following is given:

5.0 grams of gas black
2.0 grams of binder
55.0 cc. water

The binder which may be methyl cellulose is dissolved in a portion of the water and the gas black added while stirring. The mixture is then passed through a colloid mill or similar device and then applied to the paper 10 by any of the normal coating methods, such as spraying, dipping, brushing, or knife coating, etc. After coating the paper, the liquid contained in the binder is evaporated off by heating or by any other suitable method. The desired degree of smoothness may then be obtained by subjecting the coated paper to calendering operation.

The next step is to apply the facsimile or masking coating 12. This coating consists of a pigment of whitish or light colored hue and a binder as above-mentioned, but it is preferable to use for the binder for coating 12 one which is soluble in organic solvents but not water soluble. Since the coating 12 must have the desired whitish hue so as to achieve a high degree of contrast when it is removed in localized areas, I have found that the best results are obtained when the pigment in coating 12 is constituted of one or more luminescent materials. Of the large group of pigments known in the art as phosphors, fluorophors or luminescent pigments, those of the greatest importance for facsimile recording purposes should be white or light colored, and of this group the ones that I have found most suitable are the zinc oxide and zinc sulfide phosphors, although phosphors of the strontium sulfide, cadmium sulfide and metallic silicate types, such for example as zinc beryllium silicate, have been tried and found to be of great value. While it is not intended to restrict this invention to phosphors or fluorophors of the zinc oxide, zinc sulfide or metallic silicate types, these phosphors will be used to describe the general properties and method of manufacture of the coating 12.

Phosphors consisting of zinc oxide or zinc sulfide are composed essentially of a matrix of zinc oxide or zinc sulfide with a small percentage of a metal like copper, manganese, bismuth, cadmium, etc., in activating relation to said matrix. They are prepared by methods known to the art in which the components are subjected to temperatures of the order of 1000° C. in the presence of air or other gases and later brought to room temperature by various means. The electrical and other properties of the pigments thus formed are believed to be due to the type of crystal lattice which they possess which gives rise among other things to a rather free flow of electrons when they are subjected to an electrical stress.

It has been found that some of the zinc oxide and zinc sulfide phosphors have very little covering or hiding power so that in preparing an actual surface coating for a facsimile paper, the addition of some other pigment excelling in these properties may at times be necessary. Thus it has been found that facsimile papers having good

recording properties can be made in which as little as 10% of a phosphor is present. However, good papers have been made with pigment consisting of 100% phosphor pigment or a high percentage of such pigment. Ordinary zinc oxide or zinc sulfide pigments have been found most satisfactory for blending purposes.

The brightness or whiteness of papers prepared in accordance with this invention is greatly improved over prior papers. In addition, under restricted illumination they show a still greater improvement due to the luminescent and phosphorescent character of the pigments which they contain. Examples of surface coatings containing phosphors:

Example 1

240.0 g. zinc sulfide
24.0 g. zinc sulfide phosphor
25.0 g. nitrocellulose ½ second viscosity
20.0 g. ethycellulose 10 cps. viscosity
35.0 g. plasticizer
200.0 g. solvent composed of 30% butyl acetate, 50% toluene, 13% ethanol, 7% butanol

The above example shows a pigment combination of ordinary zinc sulfide and a phosphor.

Example 2

240.0 g. zinc sulfide phosphor
25.0 g. nitrocellulose ½ sec.
20.0 g. ethycellulose 10 cps.
35.0 g. plasticizer
200.0 g. solvent having a composition the same as Example 1

The above example shows a pigment combination consisting of 100% zinc sulfide phosphor.

Example 3

240.0 g. zinc sulfide
48.0 g. strontium-calcium sulfide phosphor
25.0 g. nitrocellulose ½ sec.
20.0 g. ethycellulose 10 cps.
35.0 g. plasticizer
200.0 g. solvent having a composition the same as Example 1

The above example shows the use of a strontium-calcium sulfide phosphor.

Example 4

250.0 g. zinc oxide phosphor (made in accordance with U. S. P. 2,408,475)
25.0 g. nitrocellulose ½ sec.
20.0 g. ethycellulose 10 cps.
35.0 g. plasticizer
200.0 g. solvent having a composition the same as Example 1

This example shows the use of a zinc oxide phosphor.

The lacquer coatings described are made by dissolving the nitrocellulose, ethycellulose, tricresyl phosphate in the thinner adding the pigment and lightly grinding or dispersing the pigment by ball milling, colloid milling or similar procedure.

The lacquer so prepared is quite viscous and may be further thinned with the solvent given, to produce a composition that is suitable for coating. Any one of the several methods of coating lacquer coatings such as roll coating, spraying, dipping or knife coating, may be used to apply the coating to the paper.

The coating may be applied over the electrical conducting film 11 in sufficient thickness to cover the surface of the paper with a light uniform

coating. Thereafter the coating is dried by evaporation of the solvent by heating or any suitable method. The paper may then be subjected to a slight calendering in order that the surface may be smooth.

In all of the above examples many substitutions may be made. Thus the plasticizer combination of tricresyl phosphate and Victawet 12 (a triorgano phosphate ester) may be changed to any one of a number which will suggest themselves to those skilled in the art. The solvent and cellulose derivative combinations may also be changed if so desired.

It will be understood that the invention is not limited to a blank in which the coating 12 consists entirely of the above-mentioned luminescent pigments. In some cases, it may be desirable to control or increase the electrical conductivity of the coating 12 in which event there may be added a small percentage of a conducting pigment or finely divided metal such as colloidal silver or powdered aluminum or carbon black to impart the desired slightly conducting properties to the coating 12.

While in the foregoing description and in the drawing, reference has been made to a blank consisting of an ordinary white or colored paper 10, having a dark or black surface conducting film 11, to which the masking coating 12 is applied, it will be understood that the paper 10 may be of a type which has incorporated directly therein the necessary amount of carbon black or gas carbon so as to impart directly to the body of the paper the desired conductivity and blackness. The coating 12 according to the invention can then be applied directly to the surface of this conductive paper (Fig. 2).

Referring to Fig. 3, there is shown in generalized schematic form, a telefacsimile recording and duplicating system wherein the numeral 13 represents any well-known form of telefacsimile transmitter whereby the subject matter to be transmitted is scanned in successive areas of elemental size to produce corresponding electric signals. These signals are transmitted over a suitable transmission channel 14 to the facsimile receiver 15, the output of which is applied to the recording needle 16. The needle 16 is in slight contact with the recording blank 17 which is carried by the rotating drum 18. The drum 18 is rotated and advanced longitudinally in any manner well-known in the facsimile scanning arts and in synchronism with the corresponding scanning equipment at the transmitter 13. The recording blank 17 is formed of a base of paper having two superposed layers corresponding respectively to layers 11 and 12 of Fig. 1. As a result of the potential at the needle electrode 16, the outer or facsimile layer 12 is removed at the points corresponding to the original subject matter scanned at the transmitter 13 thus exposing the black surface 11. The subject matter is therefore directly produced on the blank 17. This blank containing the recorded intelligence can then be used directly as a matrix for making photographic prints. For example, when it is desired to make a photographic print, the blank 17 carrying the visual representation or picture can be exposed to a suitable source of light or even sunlight so as to make sure that the luminescent background of the blank has the desired luminescence and this blank can then be placed in contact with a sensitized photographic film. The luminescent character of the background of the record blank will correspondingly

act upon the sensitized emulsion of the photographic film to produce a print without the necessity of employing a separate source of light such as is ordinarily required for photographic printing devices.

It will be understood that in certain of its aspects, the invention is not necessarily limited to a coating 12 which has a whitish hue, for example the luminescent pigments that are embodied in the coating 12 may consist of one or more deep colored phosphors, such as a red phosphor, a green phosphor, or a blue phosphor, so as to impart any desired color to the coating 12; or alternatively, these deep colored phosphors may be mixed with a whitish hue phosphor so as to obtain any other desired electrical properties and color properties for the surface 12.

Various changes and modifications may be made herein without departing from the spirit and scope of the invention.

What is claimed is:

1. An electro-responsive record blank having a pliable backing comprised of paper and having carbon for rendering it electrically conductive and imparting a substantially blackish color to at least one surface thereof, and a masking coating for obscuring said surface and being of a color which is of pronounced contrast with the color of said surface, said masking coating being selectively removable in localized areas in response to electric signals applied thereto, and comprising a pigment 10% to 100% of which is a metal activated luminescent phosphor to enable the thickness of said masking coating to be increased as compared with a masking coating containing a similar non-luminescent pigment for a given sensitivity of response to an applied electric signal.

2. An electro-responsive record blank according to claim 1 in which said masking coating comprises a pigment 10% to 100% of which is a luminescent zinc oxide.

3. An electro-responsive record blank according to claim 1 in which said masking coating comprises a pigment 10% to 100% of which is a luminescent zinc sulfide.

4. An electro-responsive record blank according to claim 1 in which said masking coating

comprises a pigment 10% to 100% of which is a luminescent zinc-beryllium silicate.

5. An electro-responsive record blank having a sheet-like pliable backing member which is electrically conductive and dark in color, and a masking coating of light color for obscuring said backing member and which is selectively removable in localized areas in response to electric signals applied to said areas, said masking coating including a pigment 10% to 100% of which is a luminescent phosphor pigment material which includes a metal activator to enable the thickness of said masking coating to be substantially increased to increase its masking powers while maintaining at least the same recording qualities as compared with a similar masking coating containing non-luminescent pigment.

6. An electro-responsive blank for recording electric signals applied in localized areas to the outer face of the blank, said blank having a pliable sheet-like backing which is electrically conducting and having an outer masking coating of highly contrasting color as compared with the surface color of said backing, said masking coating including a pigment 10% to 100% of which is a luminescent pigment material constituted of a matrix component and a metallic activator component to enable for a given standard of record readability the thickness of the masking coating to be increased as compared with a similar masking coating containing non-luminescent pigment.

7. An electro-responsive blank according to claim 6, in which said masking coating also includes a quantity of electrically-conducting pigment other than said luminous pigment.

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