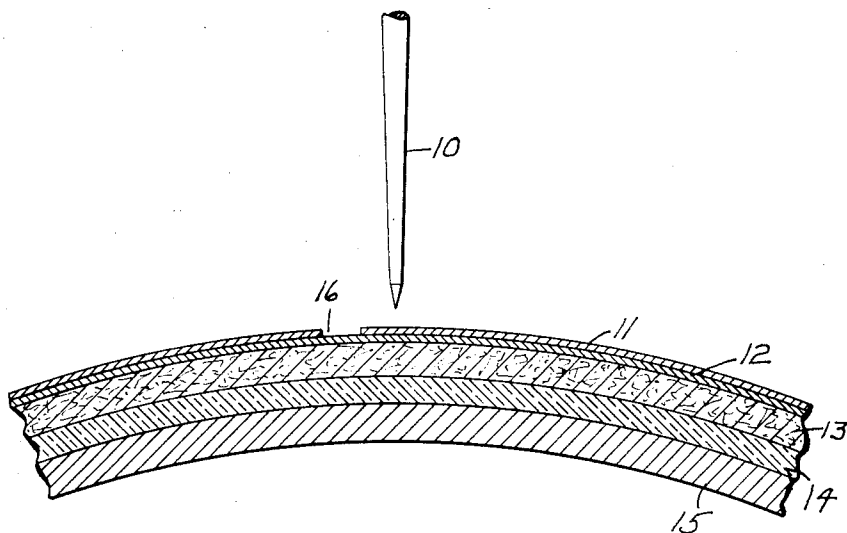


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FACSIMILE RECORDING PAPER

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FACSIMILE RECORDING PAPER

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The present invention relates to coated papers for facsimile recording or like use.

In the past facsimile recording utilizing coated papers has been performed on equipment which included a metallic cylinder and an electrode or stylus spaced from the cylinder but resting upon the recording paper which is wrapped around the cylinder. The recording was done by passing a current through the paper, which caused the coating to be burned away showing the contrasting back. With this method of recording the paper itself was necessarily electrically conducting.

The coated paper of our invention is primarily designed for use in recording, in which a like cylinder is utilized, but in which the electrode is spaced from the surface of the paper and the discharge is of the corona type as disclosed in Cooley Patent No. 1,702,595 of February 19, 1929. Due to this high frequency corona it is not necessary that the paper be conducting nor in contradistinction to the older type previously mentioned need the cylinder be metallic, nor if metallic need it be grounded.

With the type of recording above mentioned, when a non-conducting paper is utilized, we have discovered a superior result is obtained if the paper be provided with an overlying layer which is electrically conducting and which is relatively thin. This layer supplies a path for the recording electrical discharge which is of substantially uniform resistance and uniform potential gradient.

The paper of our invention comprises ordinary white paper such as writing, bond or book paper, etc., and may be either ground wood, soda, sulphite or bleached kraft paper, or a combination of the pulps mentioned. A black conducting coating is applied to this base paper, this black coating comprising "gas black" together with a suitable binder or adhesive; we have discovered that gas black is particularly adapted to the formation of a conducting coating. After applying the conducting coating to the paper a second coating called the white or facsimile coating is applied, this coating consisting of a pigment (ordinarily white) to contrast with the black, and a suitable adhesive or binder. It is therefore an object of our invention to provide a facsimile recording paper which comprises the paper proper, together with a thin conducting layer, and an overlying recording layer or surface.

It is a further object of our invention to provide such a paper in which the conducting layer serves to provide a path for the electrical discharge which is of substantially uniform resistance and substantially uniform potential gradient.

It is a further object of our invention to provide such a paper in which the conducting layer com-

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prises "gas black" together with a suitable binder or adhesive.

It is a still further object of our invention to provide such a paper in which the top or recording layer is white or nearly white, so that the contrast between it and the underlying black recording layer may be a maximum.

Other objects and features of our invention will appear when the following description is considered in connection with the appended drawing, in which the single figure shows the paper of our invention as it would appear mounted upon a drum or cylinder during the process of recording.

Referring to the drawing, there is shown at 10 the stylus or electrode beneath which there is mounted on the drum 15 (which drum may or may not be provided with an insulating coating 14) a paper 13. Paper 13 carries upon its surface the conducting layer 12 and the recording layer 11. When a high potential is applied to the stylus 10, a corona discharge will take place and a spark will occur between the point of the stylus and the conducting layer, the discharge taking place through the surface coating. This discharge will ordinarily render the surface coating partially conducting and may at the same time discolor this layer and eat it away.

In this arrangement the conducting layer acts as a plate of a condenser with the surface coating 11 and the air as the dielectric on one side, and the paper 13 and drum insulation 14 as the dielectric on the other. More exactly, the stylus 10, conducting layer 12, and metallic drum 14, act as the three plates of two condensers connected in series. Thus the potential strain is first set up between the stylus point and the conducting layer, and then passed on from the conducting layer to the metal support.

If it be assumed that the conducting layer 12 is not present, it will be seen that when recording has taken place in the area 16, and it is desired to have another recording spaced at some distance therefrom, that is, directly under the stylus 10, the path from the stylus to a point directly beneath may offer greater resistance than the path to the nearest portion of area 16. This, of course, would give an improper or unsynchronous recording. However, when our discovery is utilized and the conducting layer 12 is supplied, the path for the discharge is always of less resistance to a point directly beneath the stylus than to some other point, even though that second point be in an area in which recording has taken place.

As has been indicated above, the facsimile paper of our invention comprises paper with two separate coatings 11 and 12 thereon, whereas known facsimile coated papers comprise a paper impregnated with material to render it conducting and ordinarily to make it black, and a fac-

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simile or white coating thereon which is burned away by the current flowing through it to make the facsimile reproduction as a contrast between the black basic surface and the remaining white facsimile coating. Due to the fact that the paper has been impregnated with these known materials, the qualities of the paper are varied. For example, these known facsimile papers comprising an impregnated paper coated with the facsimile coating frequently have both their appearance and strength detrimentally affected, and the paper is not capable of being handled extensively without damage.

Other facsimile papers moistened with conducting salts such as potassium nitrate, potassium chlorate, potassium ferricyanide, etc., which decompose or are oxidized or reduced by the passage of an electric current through them and thus by way of changes in color resulting from such action produce legible records, are undesirable because of the messiness and inconvenience associated with their use.

In utilizing our invention a preferable conducting layer 12 comprises gas black mixed with any suitable adhesive such as gelatin, gum, starch, casein, wax, cellulose ether or ester, etc. The amount and kind of the binder used has a pronounced effect on the recording properties of the paper. In the case of binders of any of the types mentioned above it is desirable to use as little binder as possible and in general the amount of binder may vary from five to thirty percent of the dry weight of the gas black. It may be said in general that it is preferable to use such binders as gelatin, gum, starch, casein, wax or like materials for the black conducting coating 12 and to use binders of the cellulose ester or ether type for the white or facsimile coating 11. This is due to the fact that if the same type of binder is used for both coatings there will be a tendency for the two coatings to mingle when the facsimile coating 11 is applied, which is extremely undesirable. If the binder of the black coating is of the cellulose ester or ether type, then the facsimile coating binder should be of the wax or gelatin type. However, these wax, gelatin and starch binders are generally soluble in water and the paper would, if they were used as binders for the facsimile coating, be subject to water spotting and smearing due to handling.

As examples of the proportions of gas black and binder which may be utilized in forming conducting coatings for facsimile papers of the type of our invention the following are given:

Example I

20 grams of gas black
6 grams "Methocel," or methyl cellulose, (400 C. P. S.)
200 cc. water

The Methocel is dissolved in cold water and the gas black added while stirring. The mixture is then passed through a colloid mill and applied to the paper by any of the normal coating methods, such as spraying, dipping, brushing, or knife coating. After coating the paper the liquid contained in the binder is evaporated off by heating or any other suitable method. The paper is thereafter subjected to calendering in order that the surface may be smooth.

Example II

15 grams of gas black
20 cc. cellulose nitrate lacquer
100 cc. cellulose nitrate lacquer solvent

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In this instance the lacquer solvent and gas black are mixed together. The resulting product is passed through a colloid mill before application to the paper. The mixture may be applied to the paper by any of the methods mentioned in connection with Example I, and the steps of heating or otherwise evaporating off the liquid and of calendering will likewise be utilized as in Example No. I.

Example III

20 grams of gas black
1 gram of wax emulsion solids (paraffin wax emulsion)
1 gram potato starch
2 grams Methocel (400 C. P. S.)
100 cc. of water

In this instance part of the water is boiled with the starch; the remainder of the water, heated to approximately 45 degrees centigrade, being used to dissolve the Methocel. Thereafter the gas black, wax emulsion, and the solutions of starch and Methocel are mixed together and passed through a colloid mill before application to the paper. The application may be by any of the methods suggested hereinabove, and of course, includes the steps of evaporating the liquid from the binder and of calendering.

After the paper has been coated with this conducting coating it is further processed with the second or facsimile coating 11. This latter coating consists of a white or light colored pigment and a binder. The binder utilized may be any one of those mentioned in connection with the conducting coating, but as has been stated it is preferable to utilize a binder soluble in organic solvents for the facsimile coating, and one soluble in water for the conducting coating. Amongst the pigments which are satisfactory for use in the facsimile coating may be mentioned zinc sulphide, zinc oxide, barium sulphate, barytes, blanc fixe, lithopone, titanium dioxide, and the like. The sensitivity of some of these pigments may be improved by incorporating in them a small percentage, approximately 1%, of either mercuric sulphide, red or yellow lead oxide or stannic sulphide.

The amount of the facsimile coating necessary to produce a satisfactory recording paper is very small. The exact amount cannot be stated since variation in weight of the paper and variation in thickness of the black conducting coating will cause variations. It may be said, however, that as little coating as possible should be applied; just sufficient to cover the black conducting coating uniformly and to give the finished surface a light gray appearance. It is necessary to apply the facsimile coating in such a manner as to retain the pigment on the surface of the black coating and to guard against having the white pigment penetrate below the surface or between the black conducting particles. In order that this may be done it is necessary that the coating be dried quite rapidly since if it is dried too slowly the penetration mentioned above occurs.

Although the white or light colored facsimile coating forms no part of our invention except in combination with the particular black conducting coating mentioned hereinabove, examples of a satisfactory facsimile coating are set forth below.

Example I

40 grams of zinc oxide
2.5 grams Methocel (400 C. P. S.)
100 cc. water

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The Methocel is dissolved in cold water and the zinc oxide added while stirring. The mixture is passed through a colloid mill and applied to the paper by any of the methods mentioned hereinabove.

Example II

The mixture of this example comprises a binder of cellulose derivative in an organic solvent and is therefore preferred as a coating for application over the black or conducting coating containing a water soluble binder such as the one described in Example No. I of the black or conducting coating.

40 grams zinc sulphide
0.3 gram mercuric sulphide
10 grams "Ethocel," ethyl cellulose (10 C. P. S. medium)
1 gram Dow plasticizer No. 6 di (o-xenyl) mono-phenyl phosphate
170 grams of solvent consisting of 85% toluol, 15% ethyl alcohol (95%)

The Ethocel and plasticizer are dissolved in the solvent and the zinc sulphide and mercuric sulphide thereafter added. Then the mixture is passed through a colloid mill before application to the paper, which application may be by any of the methods herein mentioned.

What is claimed is:

1. An electrosensitive recording paper comprising a nonconductive paper base, said paper base having on one surface thereof an adherent electrically conductive coating, said conducting coating having thereon a thin adherent surface coating of such character as to be burned away in elemental areas thereof by the application thereto of electrical marking currents whereby to expose said conductive coating.

2. An electrosensitive recording paper comprising a base sheet of paper substantially free of conductive material, a thin electrically conductive adherent coating thereon, and an adherent surface coating overlying said conductive coating, said surface coating being of such character as to be disintegrated in elemental areas thereof when subjected to electrical marking currents.

3. An electrosensitive recording paper comprising a nonconductive paper base, said paper base having thereon a thin electrically conductive coating containing an adhesive water soluble binder, said conductive coating having thereon a surface coating of such character as to be disintegrated in elemental areas thereof when subjected to electrical marking currents, said surface coating containing an adhesive non-water soluble binder.

4. An electrosensitive recording paper comprising a paper base which is nonconductive insofar as signal marking currents are concerned, said paper base having thereon a thin electrically conductive coating containing a binder, said conductive coating having thereon a surface coating of such character as to be disintegrated in elemental areas thereof when subjected to electrical marking currents and containing a binder of a different type from said first-named binder, one of said types of binders being selected from a group consisting of gelatin, gum, starch, casein and wax, and the other binder being selected from a group consisting of binders of the cellulose ester or ether types.

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5. An electrosensitive recording paper comprising a paper base which is nonconductive to an extent such that it substantially prevents the conduction of electrical currents of the order of electrical marking currents, said paper base having on one surface thereof an adherent coating of conducting material uniformly distributed over said surface of the paper so that said coating readily conducts electrical marking currents, said conductive coating having thereon an adherent surface coating overlying and covering said conductive coating, said surface coating being composed of material of such character that the coating is subject to local breakdown and dispersion to expose said conductive coating when said electrical marking currents are applied to the surface layer.

6. An electrosensitive recording paper comprising a nonconductive paper base, said paper base having on one surface thereof a thin adherent electrically conductive coating, said conductive coating having thereon a thin adherent surface coating comprising a marking substance responsive to electrical marking potentials when applied to selected areas of said surface coating for producing marking effects in said selected areas in accordance with the electrical marking potentials.

7. An electrosensitive recording paper comprising a nonconductive paper base, said paper base having on one surface thereof a thin adherent electrically conductive coating, said conductive coating having thereon a thin adherent surface coating comprising a marking substance responsive to electrical marking potentials when applied to selected areas of said surface coating for producing marking effects in said selected areas, said paper base and said conductive coating providing electrical condenser elements of sufficient electrical capacity to cause displacement currents to flow in accordance with the electrical marking potentials applied to said selected areas of the surface coating.

8. An electrosensitive recording paper comprising a nonconductive paper base, said paper base having on one surface thereof an adherent electrically conductive coating, said conductive coating having thereon a thin adherent surface coating overlying and covering the conductive layer, said surface coating containing a pigment responsive to electrical marking potentials when applied to selected areas of the surface coating for producing marking effects in said selected areas and containing a smaller amount of a metallic compound which has the property of increasing the sensitivity of said surface coating to said marking potentials.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,026,872	De Forest	Jan. 7, 1936
2,141,975	Finch	Dec. 27, 1938
2,251,742	Kline	Aug. 5, 1941
2,294,146	Wise	Aug. 25, 1942
2,310,946	Finch	Feb. 16, 1943
2,328,198	Davenport	Aug. 31, 1943